FACTORS INFLUENCING FIELD PERFORMANCE: UTILIZING THE DRUG EVALUATION AND CLASSIFICATION (DEC) PROGRAM TO IDENTIFY SUSPECTED IMPAIRED DRIVERS AS REPORTED BY SELECTED CERTIFIED POLICE OFFICERS IN TEXAS

A Dissertation

by

MELISSA NOGGLE WALDEN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2008

Major Subject: Educational Human Resource Development

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Approved by:

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ABSTRACT

Factors Influencing Field Performance: Utilizing the Drug Evaluation and Classification (DEC) Program to Identify Suspected Impaired Drivers as Reported by Selected Certified Police Officers in Texas. (December 2008)

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This study examined how decision-making training related to the Drug Evaluation and Classification (DEC) Program was transferred to law enforcement officers, referred to as drug recognition experts (DRE), for use in identifying and assessing impaired drivers. Specifically, this study explored how particular factors observed as part of the DEC Program's decision-making process influence the DRE's prediction of a drug category that was impairing a suspected impaired driver in the enforcement environment.

Quantitative and qualitative methods were utilized to better understand the complexity of the DRE's decision-making. Factors observed from 199 drug influence evaluations (DIE) were used as a basis for the quantitative analysis. In addition, feedback gleaned from the interviews conducted with six DREs was analyzed to identify themes that described the perceptive influence of those same factors on the DRE's prediction of a drug category.

The DREs classified 88.4% of the DIEs correctly when compared to the toxicology results according to the criteria set-forth in the DEC Program's Administrator's Guide. The accuracy rates at the drug category level were 82.9% for Depressants and Cannabis, 80.9% for Stimulants, 96.5% for Dissociative Anesthetics, and 81.9% for Narcotic Analgesics. The results of the study showed that the DREs employed their DEC Program training appropriately, but reportedly used a subset of factors as a basis for their predictions. The quantitative analysis indicated that the factors the DRE expected to observe when a particular drug category was present in the toxicology results were documented as present on the DIE report by the DRE. In contrast, only a subset of those factors was unique to that drug category. The qualitative feedback from the DREs indicated that they rely on a subgroup of factors, such as those related to the eyes, as the main basis for their decision-making. The DREs also emphasized their consideration of the *totality of evidence* as major driver in their decision-making.

The DEC Program provided an interesting opportunity to explore the transfer of decision-making training. Based on the results of this study, the DEC Program can improve the transfer of training by targeting DRE's motivation to transfer training into practice, the transfer design, and the climate in which the DRE transfers their learning into performance.

DEDICATION

I would like to dedicate this dissertation to my family. Their patience has been without fault and their encouragement is the foundation to all I accomplish in my life.

First to my wonderful, loving husband, Troy Walden, who understands the painful journey of completing a dissertation. Your patience and coaching are the reasons I have been able to complete this journey. I love you and feel tremendously blessed to have you in my life.

To my sister, Christina Heaton, who has always challenged me and helps me remember that life is not about getting things done, but rather about the experience of sharing yourself with people.

To Chase and Aimee Walden, thank you for sharing your daddy with me and making me laugh.

To my son, Trent Vittrup, thank you for your candor and the way you put things in to the right perspective. Thank you for always saying you love me more.

To my daughter, Kendall Vittrup, thank you for your joy and beautiful spirit. Your encouragement and hugs always make things better. I really appreciate you.

To my mother, Bette Noggle, thank you for always being there and loving me just the way I am. You have always been my biggest fan and that means the world to me. I could not have done this without you.

To my dad, Luke Noggle, I wish you were here.

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First, I would like to acknowledge the support of my committee members. Dr. Winfred Arthur has provided great insight as the member from outside my department. The infusion of his experience and insight has been a valuable part of the development of this dissertation. Dr. Fred Nafukho's energy and encouragement added spark at the end of a long journey. Dr. Nafukho replaced Dr. Stenning who was an integral part of my graduate work in HRD and encouraged me on into retirement. Finally, Drs. Lynham and Tolson who, as Co-Chairs, supported me through many trials. Dr. Homer Tolson has an amazing balance between toughness and support. His attention to detail during the analysis portion of my dissertation provided a rich learning experience. Dr. Sue Lynham has been a friend, colleague, and mentor throughout my graduate experience. She introduced me to the idea of *soft eyes*, which has enriched my research perspective. Without the support of each of these individuals, I would not be where I am today.

I would also like to acknowledge the support of the Texas Transportation Institute and, specifically, my manager Dr. John Mounce for providing the opportunity for me to complete my studies. Many individuals have assisted me in both large and small ways over the last few years and it is important that they realize that how much I appreciate all of their support and encouragement. Thank you.

My professors and colleagues were supportive throughout my graduate work and I felt very fortunate to have such gifted mentors who helped guide the way, but that support pales in comparison to the support provided by family and friends. Balancing a job, graduate work, and family has been an extreme challenge. My old friend and sage Dr. Margaret Purcell paved the way for me. My mother, Bette Noggle, and sister, Christina Heaton, have always been there providing a perspective that one's dissertation is not the only thing that is important. Then there are my children and step-children, Trent, Kendall, Chase, and Aimee, who never understood why I would want to put myself through all this aggravation when what I was doing seemed so boring. Finally, my husband, Troy, has offered a shoulder to cry on, many pats on a back, and so much encouragement over the years. God has blessed me with many wonderful people to aid me in my academic journey. Although this journey has been difficult from academic, personal, and professional perspectives, it has been worth the sacrifice.

"I can do everything through him that gives me strength." Philippians 4:13

NOMENCLATURE

DEC Program	Drug Evaluation and Classification Program
DRE	Drug Recognition Expert
DIE	Drug Influence Evaluation
NHTSA	National Highway Traffic Safety Administration
IACP	International Association of Chiefs of Police
HRD	Human Resource Development

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CHAPTER I

INTRODUCTION

Performance in the workplace is highly dependent on decision-making at the individual, process, and organizational levels. Decision-making is defined as a course of action(s) related to making a choice or drawing a conclusion after considering multiple inputs and options (Chermack, 2003a; Landau, 1997). In regards to human resource development (HRD), decision-making is a fundamental component of any activity (Chermack, 2003a). Kopelman and Davis (2004) used an ancient proverb to illustrate the impact of decision-making related to HRD: “to guess is inexpensive; to guess wrong is very costly” (p. 203). In some cases, the decision-making involves financial considerations while other situations are more social or organizational in nature.

Individuals use some level of decision-making in everything they do, but in the context of this study, decision-making is characterized as the process by which individuals use a specific procedure to consider data and make an informed selection or conclusion. In the field of law enforcement, the process of decision-making has a critical impact on individual performance and the outcomes are also tangible, internal constructs which affect a law enforcement agency’s (organization) effectiveness as well as externally among the general public in regards to their constitutional or civil rights if they are suspected of a crime (Kwasnoski, Partridge, & Stephen, 2000; Page, 2005).

This dissertation follows the style of *Human Resource Development Quarterly*.

Police officers are frequently required to make decisions which affect the safety and well being of themselves and others as well as determine whether a citizen's civil liberties will be restricted (Kwasnoski, Partridge, & Stephen, 2000; Page, 2005). Police officers employ decision-making strategies in low-risk situations such as issuing a citation for a simple traffic violation as well as high-risk investigations related to murder, domestic violence, and assault (Kwasnoski, Partridge, & Stephen, 2000). Interestingly, one of the most complex decision-making activities undertaken by a law enforcement officer are the investigations involving drivers who are suspected of being under the influence of alcohol and/or other drugs (Kwasnoski, Partridge, & Stephen, 2000; McAndrew, 2003; Page, 2005). The choices the officer makes as part of this decision process are conducted based on the assessment procedures taught in the Standardized Field Sobriety Testing (SFST) and Drug Evaluation and Classification (DEC) Programs (National Highway Traffic Safety Administration [NHTSA], 2007). Both of these programs were developed by and continue to be administered through the NHTSA and the International Association of Chiefs of Police (IACP). The materials and procedures presented in the courses provide officers with tools that can be employed at roadside and in control environments such as a detention facility to determine whether a drug is present in that individual and if they are impaired by a drug.

Law Enforcement Training: Detecting and Assessing the Impaired Driver

SFST Program instructors train law enforcement officers to detect and assess drivers suspected of impaired driving (driving while under the influence, impaired or intoxicated [DWI]) (NHTSA, 2007). The DWI detection process is divided into three phases: vehicle-in-motion, personal contact, and pre-arrest screening. The vehicle-in-motion phase addresses the observation of the driving behaviors and informs the officer's development of reasonable suspicion for the traffic stop. The personal contact phase which covers the officer's interaction with the driver, inside and outside the vehicle, determines whether there is enough evidence of impairment to request the driver to perform sobriety tests.

The third and final phase on the DWI detection process is the pre-arrest screening that includes the SFSTs as well as other sobriety tests as determined by the officer. The decision point for this phase is whether there is probable cause for an arrest for driving under the influence of alcohol and/or other drugs. In some jurisdictions, the officer may also request a breath sample via a preliminary or portable breath testing device (PBT). If the arresting officer suspects that the driver is under the influence of a drug other than alcohol, they may ask for additional screening by an officer with more advanced training through the DEC Program.

The DEC Program trains police officers to recognize and classify possible alcohol and/or drug impairment according to a 12-step decision-making process called a drug influence evaluation or DIE (NHTSA, 2007). After an officer completes all of the training and certification requirements, they are referred to as a drug recognition expert

(DRE). Throughout these 12-steps, the DRE identifies the presence or absence of specific factors, which help to inform their decision-making process. The result of the 12-step process is the prediction of a drug category(s) that the DRE believes is causing the impairment of the individual being evaluated. The officer may also determine that the subject is not under the influence of a drug and/or requires emergency attention for a medical condition.

The researcher investigated if factors or combination of factors identified as part of the DEC Program's 12-step process may have influenced an accurate prediction of a drug category(s) by a DRE after conducting a DIE in an enforcement environment. The issue of how DREs utilize data gathered as part of a DIE was examined through an HRD lens to better understand how the officer's decision-making process affects performance.

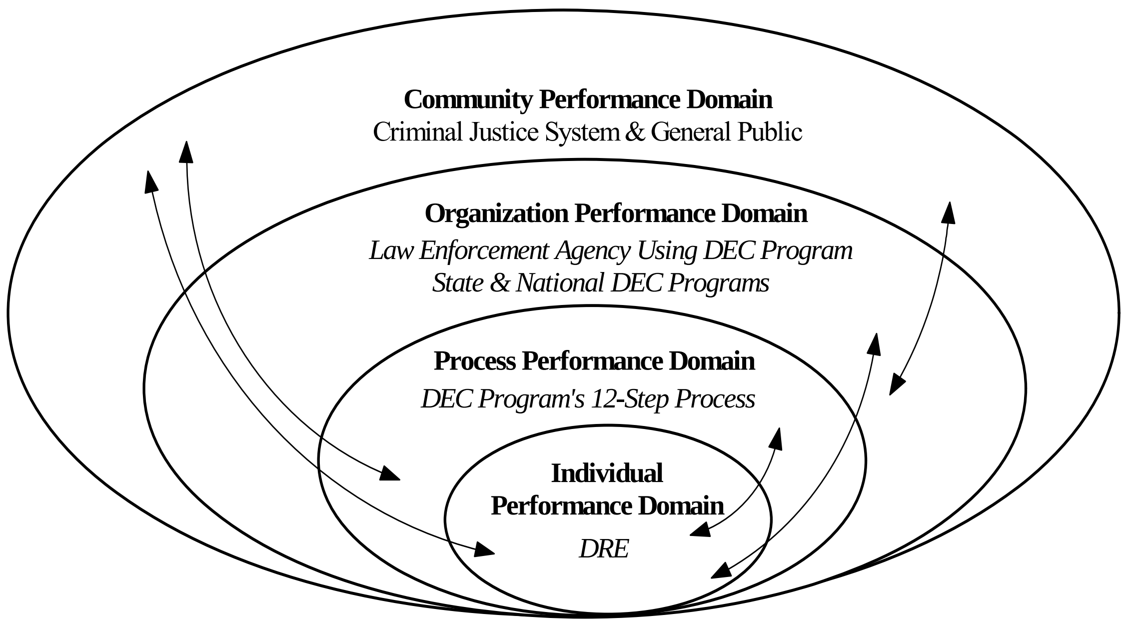
How Is This Study Related to HRD?

For the purpose of this study, human resource development (HRD) is defined as the process of developing and unleashing human expertise through training and development and organizational development for the purpose of improving performance in the individual, process, organization, and community domains (Lynham & Cunningham, 2006; Swanson, 1995). Since HRD is intended to improve performance, all interventions undertaken by HRD must ultimately enhance the system's performance. Training and development, as a part of HRD, is a critical component in impacting performance at each of the performance domains (Holton, 1999; Holton, 2002). The operational definition used in this study integrates two definitions of HRD to call out the specific performance domains of the individual, process, organization, and community.

It was important to highlight the specific performance domains since the outcomes of the Drug Evaluation and Classification (DEC) Program, the training program or the individuals trained as part of this program, that serves as the training foundation for this study, not only impacts the performance of the individual officer who is trained through this program, but also affects the ability of the DEC Program's process to be accepted by critical stakeholders at the organization and community levels. In regards to the DEC Program, the process domain is the detection and assessment continuum which is associated with impaired driving enforcement and the organization domain represents the law enforcement agencies as well as the DEC Program at the state and national levels. The community performance domain represents the legal system related to impaired driving crimes. This legal system includes prosecution, defense attorneys, courts as well as the general public through juries and public perception.

The performance of DREs trained and certified through the DEC Program impacts this entire continuum. At the extreme, poor performance at the individual level can affect whether the court accepts the evidence gathered during a DRE's evaluation of a suspected impaired driver or whether jury members trust the application of the DRE's skills. The results of which can generate case law that does not support the use of the DEC Program process in the enforcement environment. Consequently, if an assessment or evidence gathering process such as the DEC Program process is deemed unacceptable by the courts, countermeasures aimed at reducing impaired driving and the associated crashes will be adversely impacted. An illustration of the relationship between the performance domains in the DEC Program is provided in Figure 1.

Figure 1. Relationship Between the Performance Domains Related to the DEC Program



Impacting the Performance Domains

The employment of a decision-making process in law enforcement to assess suspected impaired drivers provides an occasion for HRD professionals to study outcomes of the transfer of training on the different performance domains. Although the organization and community domains will be discussed in brief, the available data are limited to the affects at the individual and process domains. Through this study, the field of HRD has the opportunity to be informed as to how selected training influences the decision-making process employed in the enforcement environment as well as to compare the individual’s performance to a standard protocol.

Training activities command a significant commitment by organizations from both operational and fiscal perspectives. In the case of training law enforcement officers to detect and assess impaired drivers, the commitment extends beyond the organization to the individual, process, and community domains. A law enforcement agency (organization) must set aside time for the training while balancing the need for community security (patrol, investigation, traffic enforcement, etc.) with staffing levels which are frequently below requirements. The individual officer must balance impaired driving training with other mandated continuing education, on- and off-duty assignments as well as court appearances.

The investigation process related to impaired driving enforcement is impacted by this training. Once an officer is trained to employ standardized procedures to detect and assess the impaired driver, then the process they employ in the field must reflect the scientifically accepted procedures acquired through that training. Disregard for the accepted procedures or validated methods may result in less than effective performance on the part of the officer and, subsequently, impact the admission of the evidence into the court.

Performance in a Unique Community Domain

Within the community performance domain, there are several stakeholders. First, NHTSA provides most of the funding and technical support for this training program through national programs with the IACP and the Transportation Safety Institute as well as through the state's traffic safety programs. This support allows law enforcement agencies to train their officers at minimal cost and provides specialized technical assistance to officers, prosecutors, and judges. The federal funding associated with the DEC and other impaired driving programs are significant, therefore a high level of performance is expected at each of the performance domains.

In addition to the federal agencies, the criminal justice system and the general public are part of the community domain. The officer's ability to perform the 12-step process influences the entire continuum of the criminal justice system as it relates to driving under the influence of drugs (DUID). This influence can manifest itself in the admissibility of evidence as well as the weight a jury or judge places on the officer's testimony. The general public is affected through jury participation as well as through their perception as to whether impaired drivers will be detected and assessed fairly. The training an officer receives as part of the DEC Program, like many other educational initiatives, impacts much more than the individual evaluation performed by the officer after an arrest.

The DRE's Impact on the Performance Domains

DREs were trained and encouraged to develop skills that were unleashed as part of a systematic employment of countermeasures to reduce impaired driving in conjunction with the traffic safety community including their own law enforcement agency. The DEC Program is intended to improve performance through effective deployment of impaired driving countermeasures within individual, process, organization, and community domains. By addressing each aspect of the definition of HRD that was referenced earlier in this chapter relative to the DEC Program, it is easy to see how the researcher conducted the study through the lens of an HRD researcher and practitioner.

HRD professionals as well as representative from other disciplines examine the connection between training and its employment in the field (practice). The researcher considered the assessment of suspected impaired drivers a decision-making process that is accepted in the criminal justice community as standardized and is intended to be utilized in that manner based on previous research (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Compton, 1986; Heishman, Singleton, & Crouch, 1996, 1998). Based on that assumption, the researcher examined those decisions. This research informs HRD professionals in both a practical and theoretical manner since the intent was to use theoretical foundations to inform the study in order to determine how specific factors influence the DEC Program evaluation process. This approach resulted in conclusions that will not only inform HRD, but also serve to enlighten the DEC Program.

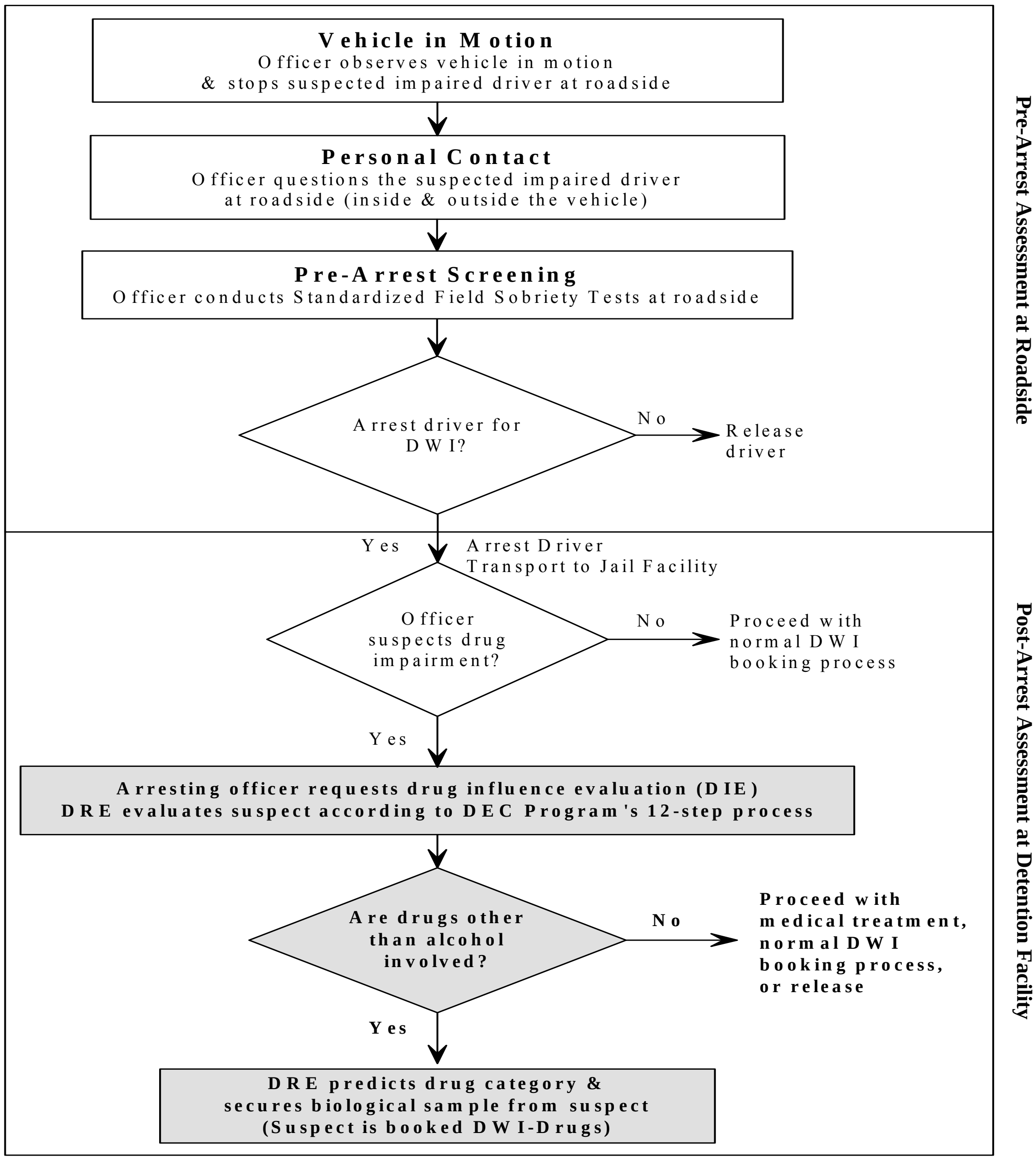
Overview of the Drug Evaluation and Classification (DEC) Program

The DEC Program training includes two weeks of classroom instruction and scenarios as well as field evaluations in the enforcement environment under the supervision of a DRE instructor. An officer who successfully completes all of the requirements of the DEC Program training is referred to as a DRE. The DRE becomes part of the overall DWI detection and assessment process by either making the initial arrest or by being called in to evaluate a subject who the arresting officer believes to be under the influence of a drug or drugs other than alcohol. The arresting officer makes observations at roadside and during the transport of the subject to a detention facility then the DRE conducts a DIE in a controlled environment, typically a detention facility, after the subject has been placed under arrest.

The DWI Detection Process

As previously described, the DWI detection process includes assessment activities, which are conducted both at roadside and in the more controlled environment of a detention facility. Although a DRE can be part of the DWI detection process as an arresting officer, they generally engage the suspected impaired driver during the post-arrest assessment. This occurs when the arresting officer suspects that the driver is under the influence of a drug other than alcohol and believes that additional evaluation is necessary. The DEC Program provides training and an assessment protocol through a standardized 12-step process, which support the post-arrest assessment when drug impairment is suspected. The DWI detection process and the integration of the DIE into that process are illustrated in Figure 2.

Figure 2. DWI Detection and Assessment Process



Note: For detailed information related to the DEC Program's 12-Step process, the reader can reference Figure 3 which identifies the specific steps that the DRE follows to make a prediction of a specific drug category.

Pre-arrest Process

The DWI detection process is divided into pre- and post-arrest assessments on the part of the law enforcement officer(s). The pre-arrest assessment process is divided into three phases: vehicle in motion, personal contact, and pre-arrest screening. These phases are conducted on the roadway while the driver is operating the vehicle and at roadside after the officer has made the traffic stop. The patrol officer observes the vehicle in motion to determine if any violation has occurred. If the officer believes a violation has occurred, they stop the vehicle and contact the driver at roadside. The personal contact phase can occur while the driver is inside the vehicle as well as after the driver exits the vehicle. The officer is looking for possible indications of impairment. If the officer believes that the driver is impaired, they proceed to the pre-arrest screening phase, which includes the SFST, to determine if the driver should be arrested for DWI.

Post-arrest Process

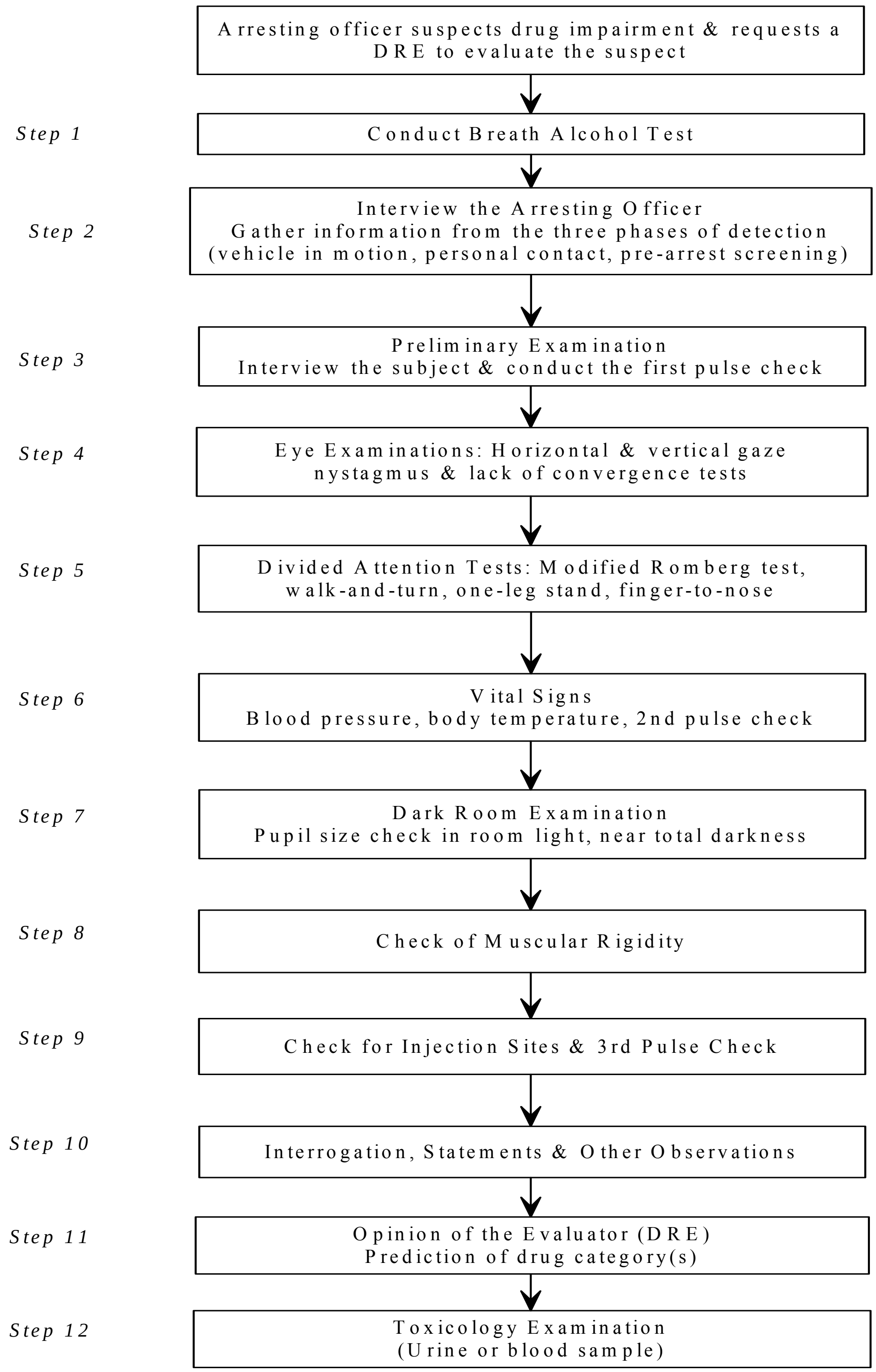
If the driver is arrested for suspicion of DWI, the arresting officer transports the individual to a detention facility for further assessment and/or the booking process. The booking process involves gathering information related to the individual being arrested including photographs, fingerprints, search of person, and routine questions related to background information (name, address, etc.). At this point, the DWI detection process transitions into the post-arrest assessment stage which is conducted inside the detention facility. The suspected impaired driver is given the opportunity to provide a breath sample to assess their breath alcohol content (BrAC). If the arresting officer believes that the subject is impaired by a drug other than alcohol, they can request an evaluation by a DRE. The DRE performs a drug influence evaluation (DIE) on the suspected impaired driver and determines if the individual is under the influence of a drug or drugs and also gathers a biological sample (blood or urine) to be analyzed by a toxicology lab to determine whether a drug or drugs is present. The totality of the evidence gathered from the pre- and post-arrest assessment processes determines if or how the driver will be charged by the jurisdiction, in which they were arrested.

The scope of this study was limited to the DWI detection process related to the post-arrest assessment and more specifically to the drug influence evaluation (DIE) performed by the DRE. These steps and decision points are highlighted in Figure 2 by shaded boxes. These steps indicate the part of the DWI detection process which is conducted by the DRE.

During each of the 12-steps, specific information as to the presence or absence of a factor is recorded on the DIE form, which is also referred to as a face sheet (NHTSA, 2007). During the first step, the DRE administers a breath alcohol test to determine the level of alcohol in the subject's system prior to conducting the remaining steps in the process. Following the breath test, the DRE interviews the arresting officer, step two, to gather data related to the three phases of detection (vehicle in motion, personal contact, and pre-arrest screening). In step three, the DRE interviews the subject to discern the general condition of the individual, including but not limited to any medication taken, injuries sustained, their appearance, and their ability to communicate. The DRE then conducts the first of three pulse checks as the final part of this step.

In step four, the DRE then proceeds to examine the subject's eyes for horizontal gaze nystagmus (HGN), vertical gaze nystagmus (VGN), and the inability of the individual to converge their eyes on a stimulus. During the fifth step, the DRE conducts the divided attention tests, modified Romberg balance test, walk-and-turn, one-leg stand, and finger-to-nose. Next, in step six, the DRE checks the subject's vital signs including blood pressure, body temperature, and pulse. During step seven, the DRE checks the subject's pupil size in three different lighting conditions. This is followed by an examination of muscular rigidity in step eight and checks for injection sites and the third pulse during the ninth step. The tenth step provides the DRE an opportunity to observe the subject as they interrogate them related to their actions before, during, and after the arrest. In step eleven, the DRE concludes whether the subject is impaired. If the subject is deemed to be impaired, the DRE predicts a drug category(s) that he or she believes is responsible for the impairment. The last step, toxicology examination (Step 12), includes the gathering of the biological sample (blood or urine) and completion of the paperwork to submit it to the laboratory for analysis. In order to provide more detail as to the individual steps in the post-arrest assessment process, the 12-step process employed as part of each drug influence evaluation conducted by the DRE is documented in flow chart format in Figure 3.

Figure 3. DEC Program 12-Step Evaluation Process



(NHTSA, 2007)

The overall DWI detection process includes assessment activities which are conducted prior to the subject being placed under arrest, at roadside, and after the arrest has been made and the subject has been transported to a detention facility. The DRE usually enters the DWI detection process during the post-arrest assessment when the arresting officer subjects that the driver is under the influence of a drug other than alcohol. The researcher specifically focused on the post-arrest assessment process during this study.

Summary of the Detection and Assessment Process

The training and enforcement activities associated with detecting and assessing the drug impaired driver is complex. In addition to understanding the DWI detection and assessment process, it is equally important that the reader appreciates the reasons why the DEC Program is a necessary countermeasure in the fight against impaired driving. In the following section, the researcher provides an overview of the impaired driving problem in the United States and describes how earlier research was conducted in order to validate the DEC Program’s 12-step process (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Compton, 1986; Heishman, Singleton & Crouch, 1996, 1998). Furthermore, the rationale for conducting a study to examine the factors or combination of factors that may influence with an accurate prediction of a drug category by a DRE after conducting a DIE in an enforcement environment are discussed to set the stage for the information presented in the review of literature in Chapter II.

Statement of Problem

The problem of drug impaired driving in the United States is discussed in this section and an overview of the research related to the DEC Program is also presented in order to frame this study. Most of the previous research related to the DEC Program has focused on validating the Program's 12-step process in the lab environment as well as in the field. Based on the framework of the previous research as well as the results, the researcher will highlight gaps, which need to be addressed to better understand performance specifically related to the DEC Program. Moreover, the researcher presented the need to examine the factors or combinations of factors that may influence an accurate prediction of a drug category by a DRE after conducting a DIE in an enforcement environment.

Introduction to the Problem

Based on the most current statistics, the Substance Abuse and Mental Health Services Administration's (SAMSHA) 2005 National Survey on Drug Use and Health, 10.5 million persons reported driving under the influence of an illicit drug during the past year. This number of people corresponds to 4.3 percent of the population aged 12 or older, which was similar to the rates in 2004 (4.4 percent), 2003 (4.6 percent), and 2002 (4.7 percent). In 2005, the rate was highest (13.4 percent) among young adults aged 18 to 25, a decrease from 14.7 percent in 2002 (SAMSHA, 2006). The statistics related to the use of illicit drugs as marijuana, cocaine, heroin, hallucinogens, inhalants, and the non-medical use of prescription type pain relievers, tranquilizers, stimulants, and sedatives are discussed in the SAMSHA report. In addition to the statistics related to drugged driving, it is interesting to note that 19.7 million Americans categorize themselves as current drug users, which means they used one or more illicit drugs in the past month. This corresponds to 8.1% of the country's population. Drugs other than alcohol (e.g., marijuana and cocaine) are involved in about 18% of motor vehicle driver deaths. These other drugs are generally used in combination with alcohol (Jones, Shinar, & Walsh, 2003). This traffic safety problem presents a significant challenge to the law enforcement community in the form of properly identifying the suspected impaired driver.

With the knowledge that individuals may be driving while impaired by a drug, law enforcement officers involved with traffic safety must have tools to effectively identify and assess drivers who they suspect are driving under the influence of alcohol and/or other drugs. In order to identify and assess these types of drivers, the officers are required to make decisions based on the evidence at hand. The training that they receive and their subsequent decision-making processes based on this training will have a major impact on their individual performance in the field and eventually the courtroom. The consequences of these decision-making processes impact officer and agency effectiveness as well as affect the lives of those who are suspected of driving under the influence of alcohol and/or other drugs (Kwasnoski, Partridge, & Stephen, 2000; Page, 2005; Walden, 2005). For an officer involved with traffic enforcement, the most complex decision-making process involves the identification and processing of drivers who are suspected of being under the influence of drugs other than alcohol (Kwasnoski, Partridge, & Stephen, 2000; Page, 2005). The drug category predictions that the officer makes as part of this decision-making process are based on the assessment procedures taught in the DEC Program (NHTSA, 2007).

Researchers have conducted several empirical studies addressing the validation of the DEC Program; however, the studies have been atheoretical in nature. The research did not address factors related to HRD, the application of skills acquired through training, or factors which influence accurate decision-making on the part of the individual DRE (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Heishman, Singleton & Crouch, 1996, 1998; Shinar & Schechtman, 2005; Walden, 2005). Previous researchers neglected to include any qualitative inquiry, which may have enlightened them as to how the DREs decided on their predictions.

The original research was undertaken in a laboratory environment and was intended to validate the procedures developed by the Los Angeles Police Department to assess drivers who exhibited behaviors that were not consistent with their breath alcohol concentration (BrAC) (Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985). A follow-up field study was conducted, in Arizona, to examine the ability of DREs to correctly assess drivers as impaired and identify the impairing substance according to the seven drug categories detailed in the DEC Program. Subsequent laboratory and field studies were completed with a larger number of subjects and a more diverse group of DREs (Heishman, Singleton & Crouch, 1996, 1998; Shinar & Schechtman, 2005; Walden, 2005). In all of these studies, the accuracy of the DRE in regards to identifying whether or not the subject was under the influence of a drug and, if so, which drug category was responsible for the observed impairment were analyzed.

Research using data collected in laboratory settings as well as the field studies dealt with the validation of the DEC Program's 12-step process, however research as to how DREs apply their training in the field and the accuracy associated with this employment was lacking. Since the DEC Program is a standardized training intervention that is intended to be utilized in the enforcement environment according to the training protocol, it is reasonable to want to examine whether or not the protocol is employed as intended and which factors or combinations of factors influence the DRE's performance. Subsequently, it is important to identify how the DREs are utilizing the training by determining which elements of the 12-step process significantly contribute to an accurate prediction on the part of the DRE. The specifics related to the need for this study, as a means to inform the individual DRE, the DEC Program, and the impaired driving community is discussed in the following section. This study can also benefit HRD since it examined how the transfer of training affects performance in the case of these selected DREs.

The Need for the Study

The decision-making process taught as part of the Drug Evaluation and Classification (DEC) Program needs to be analyzed to determine how effective the transfer of training is in relation to the performance of the individual DRE officer in the enforcement environment. This type of research will inform the training process as well as support the judicial requirements of the trial process related to impaired driving. There have been a limited number of studies conducted that concentrate on the ability of DRE to accurately identify and select specific drug categories of use while in enforcement settings. A definitive study should be conducted to determine the DRE's ability, while using the 12-step DEC Program process, to recognize and accurately select specific drug categories of use, within tested individuals, based on the standards provided as part of their training (Walden, 2005).

There have been several empirical studies conducted on the validation of the DEC Program (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Compton, 1986; Heishman, Singleton & Crouch, 1996, 1998; Shinar & Schechtman, 2005; Walden, 2005). Most of the studies were conducted in a controlled lab environment, however there was field work conducted as follow-up research. The early research studies to validate the DEC Program's 12-step process were conducted in a laboratory environment on behalf of NHTSA (Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985). Similar data was analyzed and demonstrated that the DREs who participated in the research were able to properly classify individuals as impaired as well as identify a specific drug category of abuse or a placebo (Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Compton, 1986; Heishman, Singleton & Crouch, 1996, 1998; Presusser, 1992). These studies had a limited number of DREs and included a maximum of four (out of seven) drug categories (cannabis, depressants, stimulants, and narcotic analgesics). More recent studies have endorsed the DRE's ability to identify impairment, but have raised questions as to the DRE's ability to classify that impairment according to a specific drug category(s) without information from the subject as to the particular drug or drugs they may have ingested (Shinar & Schechtman, 2005).

In addition to the laboratory studies, Adler and Burns (1994) conducted an extensive field study using the arrest records of the Phoenix Police Department and determined that the DEC Program was a reliable means of identifying drug impairment in drivers as well as at least one of the drug categories documented in the toxicology results. Walden (2005) conducted another study, utilizing Texas enforcement data, to determine the prediction rates for individual drug categories for Texas DREs. Self-reported data was used as the data-set for this study. This data was entered into a national database sponsored by NHTSA. Although the rate of reporting evaluations was not known at the time of this study, it should be noted that the data used for the study was identical to the data used by the Texas DEC Program to determine performance at the state level.

Based on the previous research related to the DEC Program, it can be stipulated that the 12-step DEC Program process is a valid method to identify a driver who may be under the influence of alcohol, drugs or a combination of both (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Compton, 1986; Heishman, Singleton & Crouch, 1996, 1998). The primary emphasis of these studies was to address the validity of the DEC Program's 12-step decision-making process (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Compton, 1986; Heishman, Singleton & Crouch, 1996, 1998; Shinar & Schechtman, 2005; Walden, 2005). Since the effectiveness of the DEC Program decision-making process in the enforcement environment is based on the effective transfer of training on the part of the DRE, it is logical to examine if the DRE, once trained and certified, can properly employ the process in the field to reach a valid and supported conclusion. In order for our society to address the issue of impaired driving, from an enforcement perspective, the DEC Program would be advised to continue to conduct research that examines the effectiveness of those processes which are employed to identify drivers under the influence of alcohol, drugs or a combination of both.

In order for the DEC Program's 12-step decision-making process to be considered fair, the suspected impaired driver and to be accepted in the judicial process, by both jurors and judges, the research must be comprehensive and sound. The research must also help to explain what happens in the enforcement environment in order for the scientifically validated process to be understood by those who are not trained to use the DEC Program's 12-step process. The traffic safety community cannot be satisfied solely with the validation of a process such as the one taught in the DEC Program. Even though a process may be valid, human beings are responsible for employing the process; therefore it is important to understand how the transfer of the process through training to the work environment affects work performance. Based on the definition of HRD offered earlier in this chapter, training is undertaken to improve performance at the individual, process, organization, and community levels. In order to determine whether the DEC Program training is improving performance, it is essential to look beyond whether the 12-step process is valid to determine if the process is improving the officer's ability to accurately identify and assess the drug impaired driver.

From an HRD perspective, it is important to examine the effectiveness of the transfer of training related to the DEC Program decision-making process by examining performance in the enforcement environment. In order to affectively inform the diverse fields related to this study including but not limited to HRD, criminal justice, and traffic safety, this type of study must be grounded by the theoretical foundations associated with transfer of training and decision-making. Previous studies did not draw on these theoretical foundations and, subsequently, did not offer the comprehensive approach that is required to analyze an issue with the significant social consequences that are associated with properly identifying, assessing, and adjudicating the impaired driver.

Development of the Problem Statement

Even though the research related to the DEC Program has served to validate the 12-step process, it has not examined how the DRE uses the training in the enforcement environment to predict whether an individual is under the influence of a drug and, if so, which drug category(s) is responsible for the impairment. Additionally, there is no research that examines the relationship between the factors considered as part of the 12-step process and an accurate prediction on the part of the DRE.

On one hand, the researchers have shown that the DEC Program's 12-step process is a valid tool for assessing individuals suspected of being impaired by drugs other than alcohol. The validation research was conducted in the lab and field environments by scientists who are considered experts in the field. On the other hand, there has been limited investigation as to the ability of the DRE to transfer the training into the enforcement environment and no determination of acceptable accuracy levels based on the individual, process, organization, and community performance domains. Furthermore, despite the validation of the 12-step process, the DEC Program does not understand how the DRE uses the information they collect at each step, referred to in this study as factors or combinations of factors, to accurately predict a drug category after they have conducted a DIE in an enforcement environment.

Therefore, the problem that was examined in this study was which factors or combination of factors influence an accurate prediction of a specific drug category by a drug recognition expert after conducting a drug influence evaluation in the enforcement environment.

Purpose of the Study

The researcher examined if the DEC Program training impacts the field performance of certified DREs in Texas. The primary purpose of the study was the identification and examination of those factors or combinations of factors which may influence the accurate prediction of a drug category by a DRE after they conduct a DIE in the enforcement environment. Additional details in regarding the components that drive the purpose of the study are included in Figure 4.

The research related to this field has been limited to the validation of the Drug Evaluation and Classification (DEC) Program's 12-step process and only in regards to a subset of the seven drug categories which the DRE is trained to assess. Based on previous research, the validity of the DEC Program 12-step process in the laboratory and controlled field settings was considered acceptable for admission into the criminal justice system (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Compton, 1986; Heishman, Singleton & Crouch, 1996, 1998). Therefore, the next logical step is to examine the DRE decision-making process in field performance that was not part of a controlled experiment.

Examining the DRE's decision-making process using the DIE data generated in the field provided insight into the DRE process from a human resource development (HRD) perspective by taking into account transfer of training and individual decision-making process. The researcher intended this study to inform the DRE decision-making process, in both the training and enforcement environments, by examining how individuals transfer their training in the 12-step decision-making process to their field performance during their enforcement activities. Such an analysis is critical from an HRD perspective since it informs the connectivity between the training and the individual and process performance domains. Additionally, the researcher highlights the strengths and weaknesses of the DEC process based on that performance.

Figure 4. Illustrative Explanation of the Purpose of the Study

The purpose of this study is to identify and examine

which *factors or combination of factors*	Results of standardized tests such as HGN, walk-and-turn and/or one-leg stand or the results of clinical observations such as blood pressure, pulse, coordination and/or pupil size
may *influence*	The frequency that a factor or combination of factors occurs when the DRE accurately predicts a specific drug category(s)
an accurate prediction	When the DRE predicts a drug category(s) & toxicology results confirms the presence of a drug in that category(s)
of a *drug category*	Classification of substances that produce similar mental & physiological effects/responses
by a *DRE*	Individual trained and certified through the DEC Program
after conducting a DIE	Standardized & systematic method used to gather observational information that serves as a basis for the DREs decision-making process
in an *enforcement situation.*	Where some form of action must be taken in order to uphold the existing laws of the state

This researcher ascertained whether the DRE’s field performance demonstrates the decision-making process taught as part of the DEC Program. In addition, this researcher attempted to determine the degree to which selected factors of the DRE’s prescribed decision-making process contributes to the DRE reaching a correct conclusion based on the recorded toxicology results. Finally, this researcher surveyed a sample of Texas DREs to examine the degree to which elements of the DEC Program decision-making process influenced their prediction of drug categories. By conducting the research in this manner, the field of HRD and law enforcement may be informed as to how the individual DRE transfers his or her training into field performance in the enforcement environment.

Research Questions

The purpose of this study was to identity and examine those factors or combinations of factors, which may influence an accurate prediction of a drug category by a DRE after they conduct a DIE in the enforcement environment. Consequently, the research questions were developed to provide the necessary information to address this purpose in the most comprehensive manner possible given the available drug influence evaluation (DIE) data.

In order to categorize those factors or combination of factors that are associated with an accurate decision of a drug category(s), the researcher had to first identify those DIEs where the DRE has accurately predicted the drug category(s) that caused the impairment according to the toxicology results. This accuracy criterion was selected based on its consistency with the burden of proof standard necessary to charge an individual with driving while impaired by drugs. The first research question was crafted to identify those DIEs with accurate predictions for each drug category on the part of the DRE.

Research Question One: To what extent do the DRE's drug influence evaluation (DIEs) predictions agree with the toxicology results?

The results of the analysis for the first research question produced seven drug category specific subsets from the original data. This data provided a framework through which the second research question was addressed. Which factors or combination of factors have an influence on a DRE's ability to accurately predict a drug category(s) after completing a DIE was examined as part of the second research question. This examination was based on dichotomous data collected from an existing set of DIEs completed during a specific two year period. This analysis was based on dichotomous data collected from an existing set of DIEs completed between January 1, 2002 and December 31, 2004.

Research Question Two: In terms of drug categories, which factors or combinations of factors have a potential influence on the accuracy of the DRE's prediction of a drug category(s) when compared to the toxicology results?

After examining the quantitative data in order to draw conclusions relative to the factors or combination of factors that were associated with the DREs' accurate predictions, the third question explored a different method of understanding the impact of these factors on decision-making from the individual DRE's perspective. In order to investigate the perceptions of the DREs, interviews were conducted. By including the direct input of the DREs, the researcher was able to glean information to address the purpose of the study in a holistic manner as well as provide a better understanding of how the DREs transfer their training, in conjunction with their experience, into their performance on DIEs in the enforcement environment.

Research Question Three: Based on their experiences as DREs, what do selected DREs perceive as influencing their ability to accurately predict a drug category(s) after conducting a DIE in an enforcement environment?

The research question builds upon the previous one to ensure the study addresses both quantitative and qualitative perspectives and adequately addresses the purpose of the study. How the purpose and the research questions are used to address the needs of the study are discussed in Table 1.

Table 1. Integration of the Purpose of the Study With the Research Questions

Purpose of the Study	Research Questions	Study Need Addressed
Identify the DIEs[5] with accurate predictions[1] according to a specific drug category[4] based on the sample of DIEs[5] collected as determined by the toxicology results[6]	To what extent do the DRE's[3] drug influence evaluation[5] (DIEs) predictions agree with the toxicology results[6]? (Quantitative)	In order to examine which factors or combination of factors[2] may influence an accurate prediction[1] of a drug category(s)[4], those DIEs[5] with accurate predications[1] were identified by comparing the DRE's[3] prediction to the toxicology results[6] based on each drug category(s)[4]
Identify the factors or combinations of factors[2] that may influence an accurate prediction[1] of a specific drug category[4] based on the sample of DIEs[5] collected as determined by the toxicology results[6]	In terms of drug categories, which factors or combinations of factors[2] may have a potential influence on the accuracy of the DRE's prediction of a drug category(s)[4] when compared to the toxicology results[6]? (Quantitative)	The DIEs[5] with accurate predications[1] according to each drug category[4] were analyzed to identify which factors or combination of factors[2] may have influenced an accurate prediction on the part of the DRE[3] when compared to the toxicology results[6]
Reveal the factors or combinations of factors[2] that the DREs[3] perceive to have an impact on an accurate prediction[1] of a specific drug category[4] based on their training and experience	Based on their experiences as DREs[3], what do selected DREs[3] perceive as influencing their ability to accurately predict a drug category(s)[4] after conducting a DIE in an enforcement environment[5]? (Qualitative)	Integration of the DRE's[3] perceptions, as to how they incorporate factors or combination of factors[2] into their decision-making process to make an accurate prediction[1] of a drug category[4] as part of a DIE[5], with the results of the quantitative analysis to provide a more complete understanding of how the factors or combination of factors[2] influence and accurate prediction of a drug category on the part of the DRE[3].

Notes:

(1) An accurate prediction occurs when the toxicology results confirm the presence of a drug category predicted by the DRE

(2) Factors or combination of factors result from standardized tests such as horizontal gaze nystagmus, walk-and-turn and/or one-leg stand or clinical observations such as blood pressure, pulse, coordination and/or pupil size or other observations by the DRE during the DIE

(3) A DRE is a drug recognition expert certified to perform drug influence evaluations (DIE) in an enforcement environment

(4)The DEC Program divides specific drugs into seven drug categories based on observable signs and symptoms in its 12-step process. These drug categories include depressants, stimulants, hallucinogens, dissociative anesthetics, narcotic analgesics, inhalants, and cannabis

(5)For the purpose of this study, the DIE was performed in the enforcement environment not as part of a training activity

(6)Toxicology results are received by the DRE and entered on their rolling log which also contains their original drug category predictions

Assumptions

The DEC Program's 12-step process is taught to law enforcement officers so that they can effectively identify and assess suspected drug impaired drivers. The following section identifies and details project specific assumptions that the consumer of this research must be aware of as they judge the application of the results of this study.

1. The DEC Program evaluation process is a valid method to assist the officer in recognizing and classifying drivers suspected of being under the influence of alcohol, drugs or a combination of both.
2. The DREs recorded all of the signs and symptoms they observed during the drug influence evaluation (DIE) on the face sheet.
3. The observations related to the DIE are documented by the DRE with the intent of maintaining a high level of data integrity based on the fact that such data are is considered evidence in a criminal investigation.
4. The toxicological sample was collected and processed according to proper evidentiary procedures as well as correctly matched to the subject's evaluation.
5. The toxicological samples were properly tested to determine the presence of a drug category(s) in the individual's systems at the time the specimen was acquired.
6. The DREs accurately reported the results of the toxicology testing on their rolling logs.
7. The DREs are not unduly biased by the DIE form and assess subjects fairly.

8. The officers who submitted DIEs to the DEC Program's State Coordinator are representative of the population for which this study was designed to analyze.

Limitations

The quantitative data used in this study was from an existing data source, therefore, there are several limitation that must be highlighted. The next section details the study limitations in regards to how the data was considered and the extent to which it can be applied.

1. Transferability of findings to other DEC Program state programs or individual DREs depending on the similarity of the evaluation practices.
2. The DIEs used to collect the data only document the signs and symptoms and do not include the detailed narrative, which accompanies most DRE evaluations.
3. The population of DIEs was limited to those with available toxicology results that were recorded on the DRE's rolling log.
4. The scope of this study is limited to the public information and data collected by Sam Houston State University (SHSU) through the Texas DEC Program.
5. The data set is limited to the DIEs which were voluntarily submitted to the Texas DEC Program State Coordinator and only included DIEs conducted during a specific time period.
6. The toxicology results collected from the individual DRE's rolling log.
7. The laboratory toxicology reports may report the presence of metabolites and other natural or legal compounds which may be documented as positive results

when impairment may not have been observed. In contrast, laboratories may employ threshold levels, which do not detect the presence of a drug when impairment is observed.

8. The researcher has limited knowledge of the individual DRE's experience. What will not be known are the anecdotal experiences on the part of the DRE that may affect their predisposition to recognize a particular drug category based on exposure in their individual, localized enforcement environment.
9. The data collected as part of the DIE is a self-reported collection of observations which are considered in conjunction with the totality of all the evidence gathered as part of the impaired driving investigation. The data analyzed as part of this study will be limited to the documentation available on the DIE.

Definition of Terms

There are several technical terms which require operational definitions in order to understand the DEC Program decision-making process and an explicit operational lexicon for the conduct and make-up of the study. Brief definitions for each of the terms associated with the DEC Program are detailed in Table 2 while the terms that are specific to the field of HRD are defined in Table 3.

Table 2. Operational Definitions of Key Terms Related to the DEC Program

Term	Definition
Alcohol Rule Out	The process by which a DRE concludes that impairment observed is caused by the introduction of alcohol into the body and not by any other impairing substance (NHTSA, 2007).
Accurate Prediction (Drug Category)	The drug evaluation expert's (DRE) prediction of a drug category as part of a drug influence evaluation (DIE) is considered accurate if that drug category is present in the toxicology results.
Blood Alcohol Concentration (BAC)	Number of grams of alcohol per 100 milliliter of blood (Levinthal 2004; NHTSA, 2007).
Breath Alcohol Concentration (BrAC)	According to Henry's Law, the concentration of a volatile substance in the air above a fluid is proportional to the concentration of the volatile substance in the fluid. Applying this law, the volatile substance is alcohol, the air above is the alveoli or deep lung air, and the fluid is blood. (Levinthal 2004; NHTSA, 2007).
Correct Prediction	The final conclusion deduced when all available facts and variables have been weighed and considered regarding the selection of a specific drug category and toxicological analysis supports the conclusion that was made (NHTSA, 2007).
Drug Evaluation & Classification Program (DEC Program)	Training that was developed by and is currently maintained by the International Association of Chiefs of Police (IACP) and NHTSA (NHTSA, 2007).
DEC Program's 12-Step Process	The certified DRE is trained to use a 12-step process, during their DEC Program training, to identify signs and symptoms that are consistent with impairment caused by one or more drug categories.
DEC Program State Program	A statewide educational effort targeting the prevention of injuries and reducing traffic fatalities through trained officer application of the DEC Program procedures on suspected impaired drivers (NHTSA, 2007).
Divided Attention Tests	Any test that divides the performing person's ability to concentrate on both a mental and physical tasks at the same time (NHTSA, 2007).

Table 2. Continued

Term	Definition
Drug	Any substance that when taken into the human body that can impair the ability to operate a motor vehicle safely (Levinthal, 2004; NHTSA, 2007)
Drug Category	Specific drugs that fall within a single classification of substances that produce similar mental and physiological effects/responses. DEC Program drug categories: depressants, stimulants, dissociative anesthetics, hallucinogens, narcotic analgesics, inhalants, and cannabis.
Drug Influence Evaluation (DIE)	A standardized and systematic method used to harvest information that serves as a basis for the evaluator's opinion/conclusion regarding whether or not a person is impaired/intoxicated (NHTSA, 2007).
Drug Recognition Expert (DRE)	Individual trained and certified through the DEC Program and have completed the required training courses and field certification phases and have passed an extensive knowledge exam as outlined by IACP and NHTSA (NHTSA, 2007).
DRE Prediction	Based on the observations made during a drug influence evaluation, the DRE identifies one or more drug categories that he or she believes to be causing the suspect's impairment (NHTSA, 2007).
Drug Evaluation and Classification (DEC) Program	The DEC Program is managed by the National Highway Traffic Safety Administration (NHTSA) and the International Association of Chiefs of Police (IACP) to training law enforcement officers to systematically identify and assess individuals who may be under the influence of a drug other than alcohol. The national agencies work directly with the states to ensure consistency in training and deployment of the program (NHTSA, 2007.
Drug Evaluation and Classification (DEC) Program State Coordinator	Each state that participates in the DEC Program has one individual and organization or law enforcement agency designated as the DEC Program State Coordinator. This coordinator provides the latest communication to the DRE community and is responsible to the training associated with the DEC program in that state (NHTSA, 2007)

Table 2. Continued

Term	Definition
DWI (Driving while Impaired)	The offense of driving while impaired by alcohol and/or other drugs. The formal offense differs from state to state (Driving While Impaired, Driving While Intoxicated, and Driving Under the Influence are common). NHTSA uses DWI to describe each state's standard impaired driving offense (NHTSA, 2007).
DWI Assessment Process	This process includes the three phases of detection (vehicle in motion, personal contact, and pre-arrest screening) as well as the assessments which are completed at a detention facility.
DWI Detection Process	The DWI detection process is divided into three phases: vehicle in motion, personal contact, and pre-arrest screening. This process is conducted on the roadway and at roadside after the officer has made a traffic stop (NHTSA, 2007).
Enforcement Environment	The police/violator interface where some form of action must be taken in order to uphold the existing laws of the state.
Face Sheet	The DRE uses a face sheet to record his or her observations during the drug influence evaluation. A face sheet is a standardized record that is released to DREs from their State Program Coordinator.
Factor or combination of factors	Factor or combination of factors are the results of standardized tests such as horizontal gaze nystagmus, walk-and-turn and/or one-leg stand or the results of clinical observations such as blood pressure, pulse, coordination and/or pupil size.
Field Performance	The process of performing divided attention tests while in realistic settings and among varying environmental conditions.
Horizontal Gaze Nystagmus	An involuntary jerking of the eyes as they gaze to the side (Citek, Ball & Rutledge, 2003, NHTSA 2007).
Impairment or Impaired	The degradation of mental and physical abilities necessary for safely operating a motor vehicle (NHTSA, 2007).
Law Enforcement Agency	Any organization funded by public monies involved in the apprehension, prosecution, and adjudication of public miscreants or in the incarceration detention supervision or control of miscreants following apprehension prosecution or adjudication. (NHTSA, 2007).

Table 2. Continued

Term	Definition
Medical Rule Out	The process by which a DRE concludes that impairment observed is not caused by an intoxicating substance but instead, occurs as a result of sickness or injury (NHTSA, 2007).
National Highway Traffic Safety Administration (NHTSA)	A federal agency under the direction of the U.S. Department of Transportation (USDOT) responsible for transportation safety and charged with saving lives, preventing injuries, and for reducing vehicle related crashes and injuries on our nation's highways.
Rolling Log	A form used to record DIEs administered by DRE's. The form is categorized by control number, subject name, date of evaluation, evaluator's opinion, and toxicology results (NHTSA, 2007).
Signs and Symptoms	Physiological and behavioral observations used by the DRE to determine whether an individual is under the influence and, if so, identify a specific drug category (NHTSA, 2007).
Standardized Field Sobriety Tests (SFST)	A set of three standardized tests developed and validated through controlled experiments supported by research funds provided by NHTSA. The three tests consist of the HGN, Walk and Turn and One Leg Stand (NHTSA, 2007).
Suspected Impaired Driver	A person who has displayed some but not all of the indictors of degraded mental or physical abilities necessary for safe operation of a vehicle, but has not been convicted of a DUI offense.
Toxicology Results	Specific findings of a laboratory's assessment of biological specimen(s) collected and analyzed. These results provide specificity regarding the impaired substance within the specimen collected (Kerrigan, 2005; NHTSA, 2007).
Toxicology Sample/Specimen	A product of human biological creation which is taken or collected for the purpose of analysis to determine whether impairing substances are present or void (Kerrigan, 2005; NHTSA, 2007).
Training Environment	In the context of the DEC Program, the training environment not only consists of classroom instruction, but also includes a field component where the DREs complete a minimum of 12 DIEs (15 in Texas) under the supervision of an instructor.

Table 3. Operational Definitions of Key Terms Related to HRD

Term	Definition
Community Performance Domain	Community is broader than an organization (Lynham & Cunningham, 2006). The relation to the DEC Program the community performance domain is intended to examine performance in the criminal justice community (e. g. court system, DEC Program at the state and national levels, etc.) well the performance system's relationship to the general public through juries and the general impression of the enforcement of impaired driving laws in a community.
Decision-making Factors	Source data identified either through assessment of performance, toxicology results, or physiological responses that drives the DRE to make an informed drug category selection upon.
Decision-making Process	A course of action related to making a choice or drawing a conclusion after considering multiple inputs and options (Chermack, 2003a; Landau, 1997). In regards to HRD, decision-making is a fundamental component of any activit (Chermack, 2003a).
Individual Performance Domain	Technologies and processes required to optimize the performance of the individual within the context of a process, organization, and community (Holton, 1999; Lynham, Chermack, & Noggle, 2004; Lynham & Cunningham, 2006)
Human Resource Development (HRD)	The process of developing and unleashing human expertise through training and development and organizational development for the purpose of improving performance in the individual, process, organization, and community domains (Lynham & Cunningham, 2006; Swanson, 1995).
Motivation to Transfer	"A trainee's desire to use knowledge and skills mastered in the training program on the job" (Yamnill & McLean, 2001, p. 197).
Organization Performance Domain	"The performance system's mission, and the goals derived from it, that specify the expected outcomes of the performance system" at the organization level (Holton, 1999, p. 29).

Table 3. Continued

Term	Definition
Process Performance Domain	Processes often cut across individuals and groups and, on occasion, organizations and are an order series of steps designed to product a desired outcome or product that has clearly defines inputs and outputs along with constraints (Davenport, 1995; Holton, 1999: Rummler & Brache, 1995)
Transfer Climate	"A mediating variable in the relationship between organizational context and an individual's job attitudes and work behavior" (Yamnill & McLean, 2001, p. 203). Transfer climate is seen as either supporting or inhibiting the application of learning in the job environment.
Transfer Design	Instructional design is one component of transfer that must account for content, culture, and other environment or situational factors to maximize the opportunity for the individual to transfer their learning to the job (Holton, 1996).
Transfer of Training	The action of applying individual learning in the workplace in order to improve performance in the individual, process, organization, and community performance domains (Baldwin & Ford, 1988; Holton, 1999; Swanson, 1995).

Summary

HRD professionals are interested in understanding how interventions can affect performance. The DEC Program is a complex HRD system with a diverse set of inputs, outputs, decision points, customers, and stakeholders. The law enforcement officer participated in extensive training that is intended to result in a particular level of performance according to research that validated its prescribed 12-step decision-making process. A significant investment of time and money to implement and maintain on the part of state and local law enforcement agencies is required by the DEC Program. Additionally, the program impacts the ability of the state to prosecute impaired drivers. Based on the significance of individual and process performance, it is important to explore what factors or combination of factors influence the decision-making process of DRE in the enforcement environment in an effort to optimize the program and the criminal justice system it supports. The relevant literature associated with detecting and assessing the impaired driver as well as the transfer of training and decision-making are discussed in the next chapter, *Review of Literature*.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this study to is to identify and examine which factors or combinations of factors may influence the accurate prediction of a drug category(s) by a drug recognition expert (DRE) after conducting a drug influence evaluation (DIE) in the enforcement environment. In order to address the purpose of the study, it is necessary to review previous research and determine how it informs the proposed investigation. It was necessary to examine the existing literature that addresses not only the Drug Evaluation and Classification (DEC) Program, but also those publications which speak to the theoretical frameworks related to the transfer of training and decision making in relation to HRD.

Introduction

The researcher's interest in how individual performance may be influenced by a decision making processes taught as part of standardized training motivated this research study. This interest was specifically targeted towards how specially trained law enforcement officers utilize their observations along with signs and symptoms identified during their evaluation of a subject to predict a drug category(s) that the DRE believes to be responsible for the impairment of a driver under investigation for operating a motor vehicle while impaired. This study was framed in terms of human resource development (HRD) since the focus was how training in a standardized decision-making process is transferred into workplace (enforcement environment) and, more specifically, individual performance.

The structure of this chapter is divided into three major sections: HRD and transfer of training, decision-making and performance, and the Drug Evaluation and Classification (DEC) Program. The researcher addressed the following areas:

- The operational definition of HRD which will serve as a foundation for this study
- Identify how the DEC Program is relevant to HRD
- Define transfer of training
- Identify a model for the transfer of training
- Discuss theoretical frameworks for the transfer of training

In the second part of this chapter, the researcher provided the following:

- Identification and discussion of the theoretical frameworks that inform decision-making in relation to HRD
- Discussion of decision-making in terms of individual performance
- Demonstration of how decision-making informs HRD and the transfer of training

In the third part of this chapter, the researcher discussed the following:

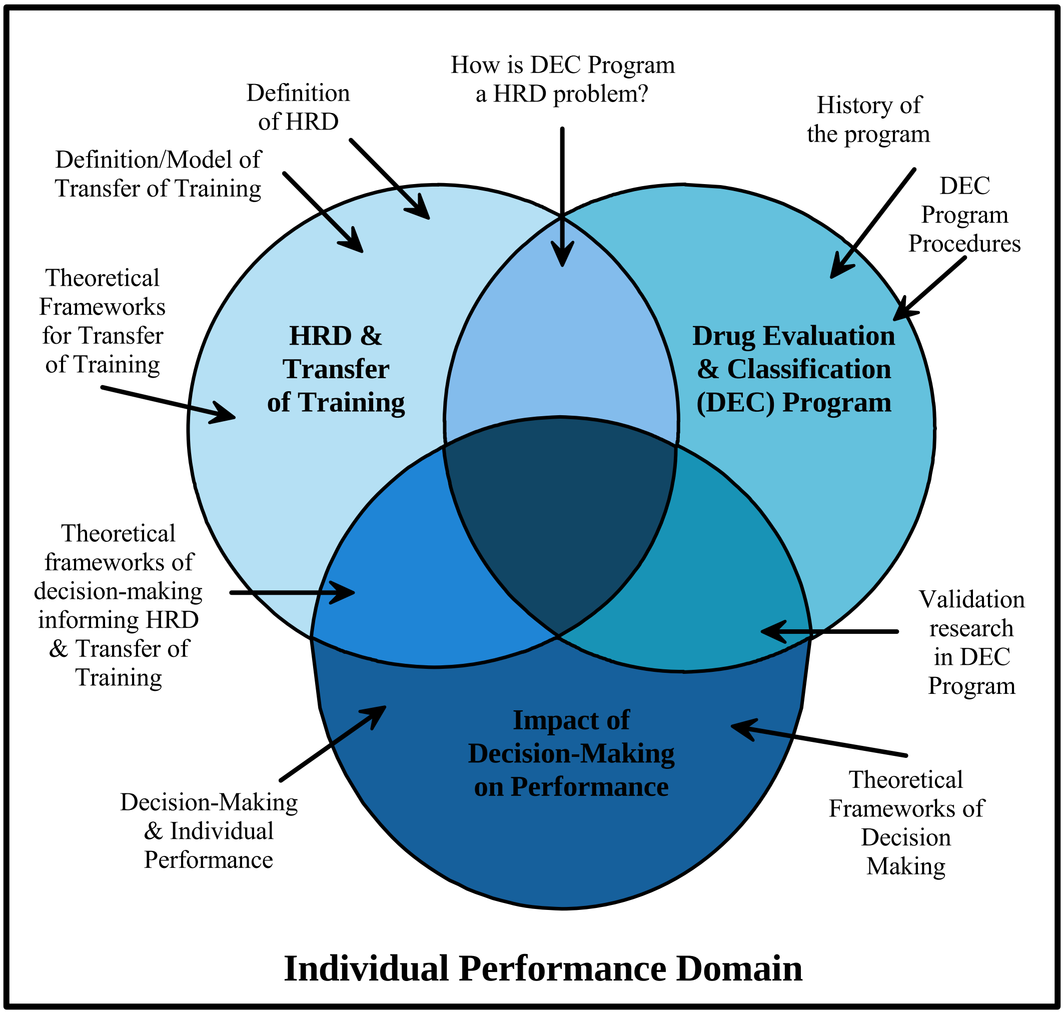
- A historical perspective of the DEC Program
- Overview of the DEC Program's 12-step decision-making process
- Discussion of how the DEC Program's process were validated through research

In the final part of this chapter, the researcher integrated the information gleaned from the three areas of literature to inform the overall purpose of this study.

Framework for the Review of Literature

In an effort to illustrate the essential elements related to this review of literature, a Venn diagram that identifies the three major areas of investigation as the DEC Program, HRD and the transfer of training, and the impact of decision making processes on performance has been illustrated in Figure 5. More detailed information as to how those major areas intersect or interact is also included in the diagram. Consequently, a new, integrated area is formed at the center that addresses how this intersection serves to better inform the purpose of the study in terms of which and how the factors or combinations of factors influence an accurate prediction of a drug category by a DRE after conducting a DIE in the enforcement environment.

Figure 5. Venn Diagram Illustrating Areas Discussed in the Review of Literature



The Venn diagram in Figure 5 has been labeled to clearly designate the information that will be included in the review of literature for this study. The circles represent the areas for research discussed in this chapter: research and evaluation related to the DEC Program, the impact of decision-making, and HRD and the transfer of training. HRD and transfer of training section addresses how HRD was operationally defined and which theoretical frameworks and models for the transfer of training were employed in this study. Next, the history of the program, the 12-step process employed by DREs when conducting a drug influence evaluation, and the validation studies that support the employment of the 12-step evaluation process were addressed. Finally, the researcher examined selected theoretical frameworks related to decision-making and highlighted how decision-making affects individual performance. The intersections of the circles have been detailed in Table 4.

Table 4. Interactions and Interrelationships of the Three Research Areas

Intersection of Major Sections		Description of the Intersection
Impact of Decision-Making	HRD & Transfer of Training	Theoretical frameworks of decision-making informing HRD/Transfer of Training
HRD & Transfer of Training	DEC Program	How is the DEC Program and HRD/Transfer of Training problem?
DEC Program	Impact of Decision-Making	Validation Research in DEC Program

Note: The center of the Venn diagram (location where all three circles intersect) addresses how the transfer of training and theoretical frameworks of decision-making, in terms of HRD, inform the DEC Program process and the results of this study as to which factors or combination of factors influence the accurate prediction of a drug category by a DRE after conducting a DIE in an enforcement situation.

The review of literature concludes with how the intersection of these three areas can inform the DEC Program as well as the results of the study. This approach to reviewing the literature will not only clearly define the existing literature and the gaps, but will also serve to inform the results.

Foundational Definition for HRD

HRD is defined in this study as the process of developing and unleashing human expertise through training and development and organization development for the purpose of improving performance in the individual, process, organization, and community domains (Lynham & Cunningham, 2006; Swanson, 1995; Swanson & Holton, 2001; Weinberger, 1998). How well training is transferred is a central element of training and development and has a significant impact on how that training translates into performance (Seyler, Holton, & Bates, 1998; Swanson & Holton, 2001). Performance is defined as focused behavior or actions, in terms of means and consequence, which are relevant to the organization's achievement of specific or defined results (Gilbert, 2007; Rudman, 2003). It can be scaled or measured in terms of the level of proficiency or contribution to the goals that are represented by a particular action or set of actions (Campbell, 1999).

HRD and the Drug Evaluation and Classification (DEC) Program

Performance in terms of the DEC Program's 12-step process is based on how accurately the DRE can identify the signs and symptoms of impairment, translate them into factors, and then classify that impairment in terms of a drug category. There are individual factors or combinations of factors related to the DEC Program, which influence the DRE's decision-making process and, subsequently, impact the outcomes. These outcomes are defined as the detection of impairment and the prediction of a specific drug category(s) responsible for an individual's impairment. The decision-making process that the DRE uses to classify the drug category(s) in those cases where general impairment has previously been detected was the general focus of this study.

Understanding which factors or combinations of factors influence the DRE's accurate prediction of a drug category can help improve performance in the enforcement environment as well as inform the training process. Based on the premise that consistent and accurate predictions of a drug category on the part of the DRE are a desirable outcome for the traffic safety community, it was critical to examine the DRE's decision-making process during a drug influence evaluation (DIE). Even though this study made the assumption that the DEC Program's 12-step process is a valid means of predicting a drug category, the previous validation research associated with the DEC Program was summarized and analyzed as part of this study.

The DRE receives extensive training to prepare them to utilize the 12-step process in the enforcement environment.. The training is delivered in a traditional classroom as well as through case study scenarios and supervised field evaluations.

Since decision-making training was a vital part of this process, it was important to examine, from an HRD perspective, what affects the transfer of training to the DRE in order to optimize the learning and performance associated with the DEC Program. Additionally, after the DRE is trained and employing the 12-step process in the field, it was important to explore how the DRE integrates the data collected during the drug influence evaluation in their decision making process.

If HRD is concerned with improving performance, then analyzing how specific factors or combinations of factors influence an individual's decision-making process and, subsequently, performance in their job environments is consistent with the HRD mission. By combining that concept that an individual's performance is an outcome of a training intervention, then additional credence is gained by approaching this study from an HRD perspective.

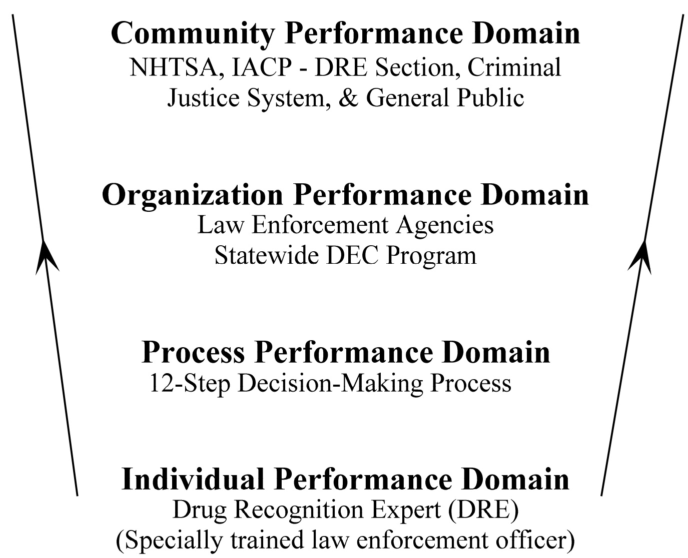
HRD and Transfer of Training

In a performance oriented HRD paradigm, it is important to recognize that performance needs to be the external result of the internal behavior of learning (Holton, 1996; Holton & Baldwin, 2003; Kim, 2004; Yamnill & McLean, 2001). From economic and organizational perspectives, training, and the learning associated with it, is of little value unless it translates in some way into performance (Holton, Bates, Seyler, & Carvalho, 1997; Kim 2004; Yamnill & McLean, 2001). At its core, the transfer of training is how the acquisition of knowledge, skills, and attitudes are linked to individual change and, subsequently, performance (Holton & Baldwin, 2003; Kim, 2004; Yamnill

& McLean, 2001). Individual performance is a critical component of organizational performance as well as a necessary condition of process and community performance (Kim, 2004; Lynham & Cunningham, 2006).

In the context of this study, the community performance domain includes stakeholders such as state and federal funding agencies, the criminal justice system as it applies to impaired driving and the general public; it is easy to see the impact of an individual officer's performance on a complex, broad-based system. Details related to the stakeholders that are engaged in each performance domain are provided in Figure 6.

Figure 6: Performance Continuum for the DEC Program



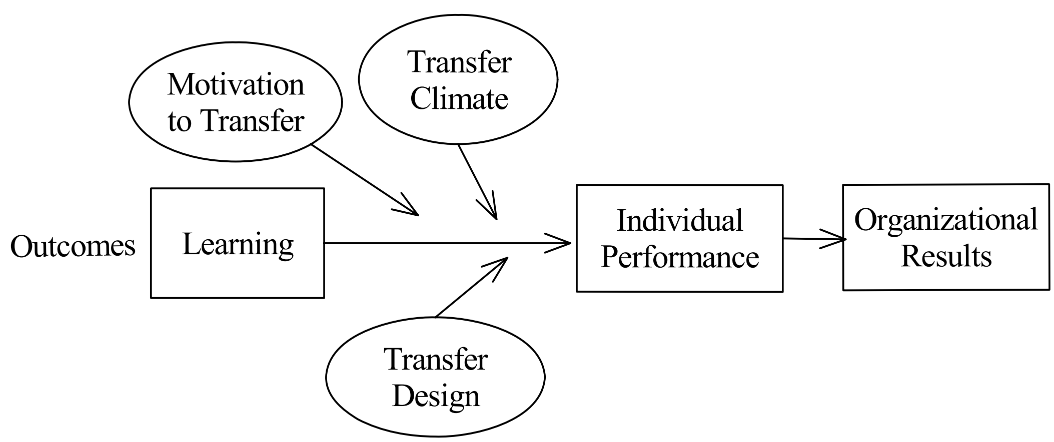
Since HRD is viewed as a systematic effort to improve performance through learning, the transfer of training, especially related to standardized decision-making, is worth the attention of scholarly research and practice (Swanson & Holton, 2001;

Torraco, 2003). Although the DEC Program has benefited from critical process validation research, the program also presents an opportunity to investigate how training is transferred into individual job performance through both quantitative and qualitative data analysis.

Model for the Transfer of Training

When organizations analyze performance, they often focus on identifying why performance is less than some desired standard by looking back from the outcome rather than looking at the whole performance system which included all of the domains. In order to effectively examine the transfer of standardized decision-making training, the DEC Program, this study employed Holton's (1996) model of Factors Affecting the Transfer of Training which is illustrated in Figure 7.

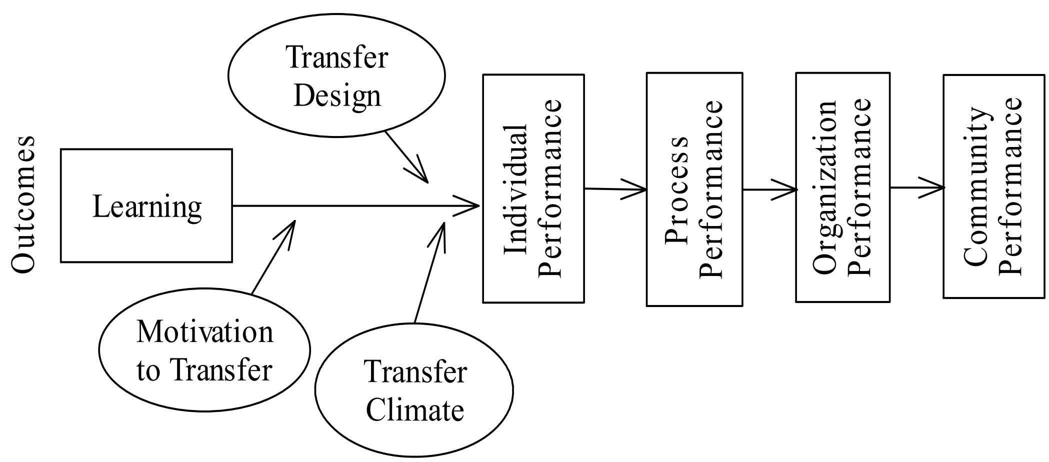
Figure 7. Holton's (1996) Model for Factors Affecting the Transfer of Training



The model is linear; rooted in learning and progressing into results within the performance domains. Between learning and results (performance), Holton (1996) identified external inputs or conditions of the system in terms of motivation to transfer, transfer design, and transfer climate.

For the purpose of this study, Holton's model was adapted to include representation of the process and community performance domains. The adaptation of the model moves beyond the primary link between individual change and organizational results to include a boarder system that encompasses process and community performance domains (Kozlowski & Salas, 1997; Lynham & Cunningham, 2006; Yamnill & McLean, 2001). The adapted model for the transfer of training is presented in Figure 8.

Figure 8. Adapted Model for the Factors Affecting the Transfer of Training



(Adapted from Holton, 1996)

The adapted model continues to be linear in nature and suggests that individual performance feeds into process, organization, and community results in a sequential fashion. Although this study focused on the individual performance domain, it was important to provide the consumer of this research with a general appreciation of the wide-reaching impact that an individual DRE's performance within their decision-making process can have on the overall performance system. See Figure 6.

Theoretical Foundations for the Transfer of Training

The theoretical foundations which inform Holton's transfer of training model center on the conditions that affect the transfer of learning into results. These foundations speak to three dependent areas (Holton, 1996; Holton, Bates, Seyler, & Carvalho, 1997; Yamnill & McLean, 2001):

- Why individuals want to change their behavior and/or performance after attending training (motivation to transfer)
- What training design and/or delivery system contributes to the successful transfer of knowledge, skills, and attitudes into the performance domains (transfer design)
- What organizational or community environment supports individuals as they apply their knowledge, skills, and attitudes gleaned through training (transfer climate)

Motivation to Transfer

The motivation to transfer training is the condition that illustrates an individual's desire to use their training on the job (Latham & Pinder, 2005; Noe & Schmitt, 1986; Yamnill & McLean, 2001). It is important to understand what drives an individual to apply the knowledge, skills, and attitudes in the workplace. What an individual expects or considers as a possible outcome of that application of training is a critical aspect of the motivation to transfer condition.

Vroom's (1964) expectancy theory deals with motivation and management. It takes into account that individuals believe there is a positive correlation between effort and performance and that favorable performance results in some desired reward. In relation to the transfer of training, expectancy theory manifests itself within an individual's expectation of intrinsic and/or extrinsic rewards based on their performance related to the training. The motivation to transfer can be considered a cycle that starts with *what's in it for me* (the individual) and moves on to combine abilities, traits, and job understanding along with skills, knowledge, and attitudes learned through training (Holton, 1996; Holton, Bates, Seyler, & Carvalho, 1997; Latham & Pinder, 2005; Lee, Locke, & Latham, 1989; Noe & Schmitt, 1986; Yamnill & McLean, 2001).

In the case of the DEC Program, the motivation to transfer is often rooted in how well the individual DRE believes the 12-step process will work in the field. The DEC Program combines classroom and scenario training with field exercises. Each trainee must complete a minimum of twelve field evaluations as well as observe others perform. These activities allow the trainee to complete drug influence evaluation on multiple, drug impaired individuals who have been arrested by local law enforcement. The trainees predict which drug category(s) that they believe is impairing the suspect's behavior. The instructor conducts a preliminary urinalysis and the trainee receives immediate feedback based on the results. The field exercises reinforce the officer's training and expectations so that they can better apply their new knowledge and skills in the enforcement environment.

Although the primary rewards appear to be intrinsic since there is an immediate sense of accomplishment, the trainee is able to visualize how the outcomes of the training can provide resources to better identify and assess impaired drivers.

Transfer Design

The second condition that influences the transfer of training from learning to individual performance depends on the transfer design and whether the training is framed in such a fashion to promote effective, job-related transfer (Goldstein, 1980; Holton, 1996; Yamnill & McLean, 2001). In order to facilitate the transfer, the training must provide for opportunities to practice, demonstrate the objectives in terms of the job context as well as translate the knowledge, skills, and appropriate attitudes so the individual can apply them readily in their work environment.

If organizations want employees to be able to apply their knowledge, skills, and attitudes acquired in training to a broad base of work situations then the learning must require activities that have identical elements to those in the performance setting and principles that prepare the learner to solve problems which may be more complex or abstract. This approach combines the characteristics of identical elements theory and principles theory to address issues of near transfer (applications similar to those in the learning environment) and far transfer (applications that are dissimilar to those in the learning environment).

The issue of near and far transfer are critical to the transfer of training in the DEC Program. Most of the classroom and scenario training in the DEC Program focuses the signs and symptoms related to the effects of single drug categories. This approach is easier to understand and provides a foundation for the more complex situations that an officer is likely to encounter in the enforcement environment. The field evaluations give the learner the opportunity to see how the effects of multiple drugs manifest themselves in individuals. This experience is important because it forces the officer to draw on the principles gleaned from the DEC Program training and apply them in a situation which is more representative of the enforcement context. The officer must think though how the signs and symptoms of an individual drug category interact with the effects of another drug category. The officer must draw on knowledge and skills transferred using both identical elements and principles based frameworks.

Transfer Climate

The final condition influencing the transfer of training is the organizational climate that an individual perceives regulates their work environment (Holton, 1996; Holton, Bates, Seyler, & Carvalho, 1997; Yamnill & McLean, 2001). The work environment can be limited to a team or organization, but it also could involve include a community. In the case of the DRE, the transfer climate includes influences from fellow officers, their agency, the state traffic safety community, prosecutors, judges, and the general public. In other words, how will for the work environment support or inhibit the individual from applying the knowledge, skills, and attitudes gained through training has a critical effect on how effectively training is transferred. The transfer climate is “seen as a mediating variable in the relationship between the organizational context and an individual’s job attitudes and work behavior” (Yamnill & McLean, 2001, p. 203).

Organizational theory helps to explain the phenomenon of transfer climate by portraying an organization as a multi-dimensional system (Olsen, 1998; Yamnill & McLean, 2001). Organizations are more than physical entities; they have additional aspects that are human, social, technological, and economic. Some organizational dimensions are tangible while others are more difficult to measure. These organizational systems are bounded (some more than others) and interact with and adapt to outside environments in order to survive and thrive.

After the officer completes the DEC Program, he or she will be available to assess individuals suspected of being impaired by drugs for their law enforcement agency. The organization can embrace the new DRE’s skills and reinforce their training investment or the agency can ignore the resource by not utilizing the officer’s skills. Another factor in the transfer climate is the agencies support of the DRE through timely testing of specimens and the recognition of the DRE’s ability to accurately identify and classify impairment. The support extends beyond the law enforcement agency to the prosecutor’s office that is charged with carrying cases forward. Additionally, the courts and the general public influence the transfer climate by their willingness to accept the training and the 12-step process as credible. Although this type of transfer climate may be more complex than most, it highlights the need to understand the extent to which the transfer climate can affect individual performance.

Summary

In this section, the researcher has highlighted how significant conditions and linkages affect the transfer of training from learning to individual performance. The cause and effects related to these conditions should be accounted for when developing and deploying training. At the other end of the spectrum, HRD professionals must consider these factors when evaluating how existing training impacts performance. By looking at the transfer of training as a system, we can appreciate how conditions external to the individual trainee affect transfer and subsequent performance.

Impact of Decision-Making on Performance

A system is an entity that maintains some level of organization in the face of internal and/or external change (Checkland & Tsouvalis, 1997; Landau, 1997; Sterman, 2000). The system which governs the transfer of training is affected by internal and external forces were discussed in the previous section. By looking at the transfer of training as a system, HRD and the DEC Program community can come to understand how these forces or conditions impact individual performance as well as process, organization, and community domains (Holton & Baldwin, 2003; Lynham &

Cunningham, 2006; Swanson & Holton, 2001; Torraco, 2003). In the following section, the researcher discusses how training in decision-making is consistent with the systems approach to the transfer of training.

"Decision-making is a fundamental component of any HRD activity" (Chermack, 2003a, p. 365). In order to optimize performance within and across the individual, process, and, ultimately, the organization and community domains, HRD professionals must work to strengthen decision-making processes. Since strategies to foster effective decision-making processes involve learning, HRD is operationally positioned to facilitate interventions among agents (elements internal to a system) and the environment (elements external to a system) that will improve performance (Torraco, 2003). By looking at decision-making from a systems perspective, the dynamics that affect the performance domains can be understood from a more holistic perspective. (Beazley & Lobuts; 1998; Brehmer, 1992; Sterman, 2000). Decision-making is facilitated and judgment is improved when we use a systems approach to understand the interrelationships of these dynamics.

Theoretical Framework of Decision-Making

The theoretical framework that serves as a foundation for understanding decision-making processes is rooted in systems theory. The function of a system is to process something (e.g. data, knowledge, or energy) within an organization of inputs, output, constraints, and dynamics to produce a product or outcome for use inside or outside the system (Beazley & Lobuts, 1998; Brehmer, 1992; Checkland & Tsouvalis, 1997; Landau, 1997; Sterman, 2000). System theory is the interdisciplinary study of the parts and processes related to the interaction of resources, mobilization, decision-making, and behavior for the purpose of increasing some valued, productive output (von Bertalanffy, 1968; Parsons, 1956a, 1956b). Systems are similar to decision-making processes in the since they have common elements such as goals, inputs, outputs, throughput, feedback loops, boundaries, and controls (Beazley & Lobouts, 1998; von Bertalanffy, 1968; Swanson, & Holton, 2001; Parsons, 1956a, 1956b).

Anderson (1980) described decision-making as a production system that is a representation in an individual's memory of procedural knowledge. Each production or process has conditions and actions that integrate concepts that have been previously learned with experience (Anderson, 1980; Gagne, 1984). Gagne (1984) further illustrated the transfer of decision-making training into individual performance through the following:

> The possession of an individual skill (an item of procedural knowledge) is shown when a person is able to apply a sequence of concepts representing condition and action to a general class of situations. (p. 379)

In order for an individual to transfer this procedural knowledge into performance, he or she must acquire a sequence at a level that can be readily retrieved (Gagne, 1984; Neeves & Anderson, 1981). Subsequently, the individual will learn to optimize that sequence so that there will be a reduced demand on resources, both internal and external. In contrast, it is important to note that this optimization may not always generate the best results. This systematic approach allows a better appreciation for the complexity of decision-making and allows researchers to better understand how to effectively evaluate and, eventually, improve the process.

Bridging the Gap Between Research and Practice

Researchers have shown that there is a critical gap between theory and practice when it comes to effective decision-making (Korte, 2003). Although traditional decision-making models are built on logic and rationality, HRD professionals can help stakeholders understand that these frameworks also need to recognize the prevalence of assumptions and biases so that potential negative effects can be mitigated. Decision-making activities are influenced by multiple physical, mental, and social factors, thereby making it contextual in nature. The notion that individuals in actual situations have a single-response to a problem is deceptive, since in reality individuals tend to evaluate information inconsistently and retain preconceived ideas (Hogarth, 1987; Korte, 2003; Rolo & Diaz-Cabrera, 2005). Understanding how people process information, solve problems, and make decisions in work environments is a complex, endeavor to which HRD processionals are well-suited to contribute (Rolo & Diaz-Cabrera, 2005).

Decision-Making and Individual Performance

Although decision-making can be simply defined as the act or process of making a choice or reaching a conclusion after considering several alternatives, the process can quickly become complicated considering that all decisions are made within some context that influences the process (Chermack, 2003a; 2003b; Landau, 1997). Individuals make decisions. They may participate in a decision-making process alone or as part of a larger organization or community and/or be influenced by environmental factors, but the act of deciding rests with the person. For that reason, it is important to examine how the ability to utilize decision-making processes affects individual performance.

The same task or decision-making process may be different depending on the situation or individual. HRD professionals need to consider that complex decisions are at the mercy of the influence of the context, demands of the environment, planning patterns and data analysis on the part of the individual, and decision sequence patterns associated with the type of task (Goldstein & Hogarth, 1987; Korte, 2003; Yang, 2003). On the other hand, individuals have internal systems for monitoring and controlling complex actions if these activities are highly routine (Das & Teng, 1999; Dörner & Schaub, 1994; Korte, 2003). Although effective decision-making is bounded by inherent individual computational abilities, limited information, the contextual environment, and a propensity to rely on heuristics or loosely defined rules gleaned from similar past experiences, training can mitigate these factors (Bazerman, 1994; Das & Teng, 1999; Herling, 2003; Korte, 2003; Yang, 2003).

The Process of Decision-Making

When individuals learn standardized, routine approaches to problem solving, they demonstrate wonderful internal systems for monitoring and controlling extremely complex actions (Dastani, Hulstijn, & Van der Torre, 2005; Dörner & Schaub, 1994; Morecroft, 1983). Replicating good decision making processes leads to the development of heuristics and the development of training in accordance to these models can improve performance (Chermack, 2003b; Forrester, 1961). Cognitive heuristics are mental models or mechanisms which are used to deal with the uncertainty and complexity associated with decision making (Bazerman, 2002). Heuristics help to simplify and facilitate a decision making process by reducing or restructuring the amount of information taken into consideration (Morecroft, 1983; Schwenk, 1986; Yang, 2003).

Anchoring. One such heuristic that must be recognized in regards to training in decision-making is anchoring. Individuals frequently use past experience as a significant basis for decision-making which provides an initial value or consideration that needs to be acknowledged (Herling, 2003; Kopelman & Davis, 2004; Korte, 2003). When based on irrelevant or information that is no longer pertinent, faulty decisions may result (Das & Teng, 1999; Kopelman & Davis, 2004). In the case of the impaired driving enforcement, more specifically the Drug Evaluation and Classification (DEC) Program, DREs tend to be officers who have a great deal of experience related to drugs and/or impaired driving. These experiences serve as a significant anchor in their decision-making process. The location of the arrest, the appearance of the suspect, information from the arresting officer, and the admission of drug use by the suspect all contribute to the DRE’s 12-step process although they are not variables that can be easily observed or measured. It is important that the DRE consider this evidence, but they must learn to balance these potential anchors with the rest of the data gathered as part of their investigation.

Heuristics and Drug Recognition Experts (DREs)

Caution should also be exercised in relation to using other cognitive heuristics or mental tools within the complex DIE process (Bazerman, 2002; Das & Teng, 1999; Kopelman & Davis, 2004). These heuristics are often employed by individuals experienced in a particular activity as methods to simplify and accelerate the decision-making process (Schwenk, 1986; Kopelman & Davis, 2004). Although DREs are bound to complete the 12-step process in a standardized manner, conscious and unconscious heuristics may be employed to reduce the amount of information taken into consideration prior to identifying a suspect as impaired and more frequently classifying category of drug or drugs responsible for the impairment (Dörner & Schaub, 1994). The impact of these types of heuristics is easily appreciated when you consider that there are in excess of 70 different variables associated with the DEC Program's 12-step process (Shinar & Schechtman, 2005).

Human conscious thinking cannot cope with more than a few data points in a limited span of time so they must economize the information (Dörner & Schaub, 1994). When actively seeking information, individuals acquire small portions that might be relevant to an activity which reflects a desire to avoid dealing with the uncertainty of information they may not understand or feel comfortable considering (Herling, 2003; Morecroft, 1983). This process is responsible for some error tendencies. It is important that individuals are made aware of these human limitations so that they can consciously avoid the impact on their decision-making.

One such heuristic is the criteria set forth by the DEC Program which defines an accurate prediction on the part of the DRE (NHTSA, 2007). If the DRE calls one category, that type of drug must be present in the toxicology results in order for the DRE to be considered correct. In contrast, if the DRE calls two drug categories only one type of drug must appear on the toxicology report for the DIE to be considered correct, so the chance of getting at least one category right is better if the DRE calls two separate categories. If the DRE calls three or more categories, then the toxicology results must identify at least two categories of the predicted drugs to be considered correct. This administrative criterion may encourage the DRE to call multiple categories to ensure their prediction is deemed correct according the DEC Program's Administrative Guideline (NHTSA, 2007).

HRD professionals can facilitate the design and implementation of effective interventions that encourage individuals to engage in purposeful decision-making. This responsibility is tied closely to the effective transfer of training which impacts the individual performance domain. Frequently, training involves the development and deployment of decision-making processes whether it addresses knowledge, skills, or attitudes. Care should be taken to ensure that the learner not only understands the required decision-making processes, but also appreciates the bounded rationalities or the limitations related to how the information is processed (Chermack, 2003b; Morecroft, 1983). Additionally, learners need to be aware of anchors and other environmental factors that can intentionally and/or involuntarily influence decision-making (Chermack, 2003b; Korte, 2003).

In the next section of this literature review, the researcher examined a how the DEC Program's 12-step decision-making process has a direct effect on individual performance. The DEC Program provides a complex, but focused example of how the transfer of decision-making training affects performance.

The Drug Evaluation and Classification (DEC) Program

The Drug Evaluation and Classification (DEC) Program is a national training program designed to educate law enforcement officers on how to assess drivers suspected of being under the influence of a drug other than alcohol. The training entails two weeks of classroom training combined with scenarios to apply the information related to specific drug categories and workshops to practice the skills associated with the 12-steps. Following the two week training, the officers participate in field training exercises designed to provide the trainee with opportunities to demonstrate their newly acquired skills in the 12-step decision-making process in an enforcement environment with instructor support.

The mission of the DEC Program is to train law enforcement officers to use a structured decision making process to determine whether a driver is under the influence of drugs and, if so, classify the impairment according to a drug category(s) (NHTSA, 2007). Burns (2005), an expert in the identification of the impaired driver, stresses the importance of effective decision making by DREs with the following:

> Prudent and timely decisions are often urgently needed when dealing with individuals who may be under the influence of a psychoactive substance.

> At such times, the decision makers will rely on their real-world experiences, as well as the findings of research. Controlled studies from scientific laboratories provide critically important data, but it would be shortsighted to view such studies as the sole source of valid information. Observational data can serve as reliable indicators, particularly when the observed signs and symptoms are essentially universal. (p. 2)

The decisions made by DREs are facilitated by an informed selectivity of data derived from training and experience (Burns, 2005). The foundation of the DEC Program is based on gathering of useful observations (physical and mental signs) and other evidence through a systematic process then utilizing that information to make an informed decision or prediction as to the whether the individual is impaired and, if so, what drug category(s) is influencing the suspect's behavior. The DRE is expected to use the decision making process taught in the DEC Program to make these predictions. A brief history of the DEC Program, a detailed description of the 12-step process, and closes with a summary of the previous research conducted in support of the DEC Program is provided in the following section.

History of the DEC Program

The DEC Program traces its roots to the 1970s in Los Angeles, California where law enforcement officers were searching for a way to better identify drivers impaired by drugs in association with or other than alcohol (Burns, Page, & Leikin, 1998; Compton, 1986; Page, 2003). Several members of the Los Angeles Police Department (LAPD) noticed a disturbing trend related to their impaired driving arrests. They were encountering a significant number of drivers who were arrested for driving under the influence (DWI) of alcohol that were exhibiting significant signs of impairment which were inconsistent with their blood alcohol concentrations (BACs). Richard Studdard and Len Leeds, LAPD officers, consulted the medical community in order to create a standardized procedure for evaluating drivers who were suspected of being under the influence of a drug other than alcohol. The result of this collaboration was the initial DEC Program (Burns, Page, & Leikin, 1998; NHTSA, 2007; Page 2003).

The National Highway Traffic Safety Administration (NHTSA) began to take an active interest in the work that the LAPD was conducting. NHTSA wanted to take a leadership role in evaluating the procedures developed by LAPD and commissioned the initial validation studies (Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985). With NHTSA spearheading the development and implementation of the evaluation protocol as well as funding the validation research, the law enforcement community began developing a training program that could support the expansion of the original DEC Program beyond the LAPD (Kozlowski & Salas, 1997; NHTSA, 2007). Following the completion of the initial validation studies, NHTSA piloted a DEC Program training program in Colorado, Arizona, New York, and Virginia. Following that pilot training, the DEC Program has become a vital part of impaired driving enforcement in may law enforcement agencies throughout the country as well as internationally. Currently, there are 39 states that are designated by NHTSA as DEC Program states and the program is also active in Canada and New Zealand (NHTSA, 2007).

The DEC Program Twelve Step Process

When an individual is arrested for suspicion of driving under the influence and the officer suspects a drug or drugs other than alcohol might be involved, the arresting officer may ask for an additional assessment by a certified drug recognition expert (DRE). This assessment is called a drug influence evaluation (DIE) and contains twelve steps which serve to gather data which are used by the DRE to determine whether or not the individual is impaired and, if so, identify the drug category(s). The twelve steps provide a standardized, systematic approach to evaluating individuals suspected of being impaired by drugs other than alcohol (Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985). There are seven separate drug categories included in the DEC Program: depressants, stimulants, hallucinogens, dissociative anesthetics, narcotic analgesics, inhalants, and cannabis (NHTSA, 2007).

In order to effectively identify these categories, there are twelve separate steps associated with DEC Program evaluation procedure and each has specific factors (e. g. blood pressure, pupil size, and balance) which provide information that the DRE will consider in their decision making process (Burns, Page, & Leikin, 1998; Kozlowski & Salas, 1997; NHTSA, 2007; Page 2003). This evaluation is commonly referred to as a drug influence evaluation (DIE). Using this consistent process is vital to the validity of the DRE's evaluation. If the DRE does not complete the 12–step process in a manner that is consistent with their training, the evaluation and the subsequent decision making process may be compromised (Burns, Page, & Leikin, 1998; Kozlowski & Salas, 1997; NHTSA, 2007; Page 2003). The twelve steps that make up the DEC Program assessment protocol are as follows (NHTSA, 2007; Smith, Hayes, Yolton, Rutledge, & Citek, 2002):

Table 5. DEC Program 12-Step Process

Step	Description	Procedure
1	Determination of BrAC	Breath test to determine whether the suspect is above the alcohol per se limit for the state. If so, the suspect is typically charges with an alcohol related offense. If the BrAC is below the illegal per se limit, then, if the officer believes that suspect is impaired, they will contact a DRE to conduct a DIE.
2	Interview of arresting officer	The arresting officer is typically not a DRE, but their observations from the DWI detection process as well as statements made by the suspect during transport or information on drugs or paraphernalia found is important to the overall DIE.
3	Preliminary examination/interview of subject	Brief interview of the suspect by the DRE to identify any medical issues and assess the general behavior of the suspect. The DRE takes the first of three pulse checks at this time.
4	Eye examinations	DRE conducts the horizontal gaze nystagmus (HGN) test, vertical gaze nystagmus (VGN) test, and lack of convergence (LOC) test.
5	Divided attention tests	The DRE conducts to Romberg balance, walk and turn, one leg stand, and finger-to-nose tests.
6	Vital signs	The DRE takes the suspects blood pressure, temperature, and second pulse rate.
7	Dark room examination	The DRE checks the suspect's pupil size check in three specific lighting conditions.

Table 5. Continued

Step	Description	Procedure
8	Check muscle tone	DRE examines the suspect's muscle tone or rigidity at bicep and forearm locations.
9	Check for injection sites	The DRE checks for injection sites on the suspect's arms, legs, and other body parts and the final pulse rate.
10	Suspect's statements	The suspect is asked about recent drug use or other behavior in an effort to gather additional information in regards to possible drug impairment.
11	Opinion of the evaluator	Based on the information collected during the 12-step process, the DRE determines whether the suspect is indeed impaired by a drug or drugs and classifies that impairment according to one or more of the seven drug categories utilized as part of the DEC Program. The suspect can also be classified as not impaired and may be released or recommended for a medical evaluation.
12	Toxicology examination	If the DRE believes that suspect is impaired by a drug or drugs other than alcohol, they will request a biological sample (typically blood or urine) which will be forward to the appropriate toxicology lab for testing.

(NHTSA, 2007)

The DEC Program's 12-step evaluation or DIE is intended to be administered in a controlled environment following an assessment at roadside by the arresting officer (NHTSA, 2007). The DIE is typically conducted at the police station or detention facility after the suspect has been arrested for a traffic violation. The controlled environment is important since some of the tests require specific physical and lighting conditions. The evaluation is conducted in an ordinal fashion according to the twelve steps.

DEC Program Training

In contrast, the DEC Program classroom training is taught without regard for the order of the twelve step process. The DEC Program training emphasizes specific signs and symptoms associated with individual the drug categories and the observational skills which are required throughout the twelve steps (NHTSA, 2007). These skills are practiced during scenarios and workshops evaluations that are included in the DEC Program training. The scenarios are used during the traditional classroom portion of the course. The workshop sessions allow the training participants to practice the majority of the 12-step process on subjects who have been dosed as part of an alcohol workshop. The field evaluations occur at the conclusion of the classroom training and provide the first opportunity for the DRE to practice his or her observational skills in terms of the 12-step process.

Interestingly, the DRE does not make his or her decision based on the sequential logic of the twelve steps. In other words, the process does not have interim decision points and the data gathered as part of a previous step does not impact the actions of the DRE on a subsequent step. The data is completely collected before the DRE makes their prediction based on the totality of the evidence gathered as part of the DIE.

The DEC Program presents training in a structured, standardized heuristic as part of the training, but additional influences such as an individual's values, experiences, and deeply ingrained assumptions about the world and the workplace environment in which an individual operates can affect how these heuristics are employed. Chermack (2003a) states that it is appropriate to assess decision making based on the product of the decision making process, in the case of the DEC Program it would be the prediction of the officer, and the process for formulating the decision. This criterion helps to inform this study in two specific ways. First, the previous research related to the DEC Program has only intended to validate the procedure.

In order to take the research a step further, the researcher explored if and how the DREs are utilizing the decision making process taught as part of the DEC Program training in the enforcement process. By understanding how the individual DRE discerns which information is considered, the researcher can identify areas where the standardized heuristic may be improved. Secondly, previous researchers have not investigated which specific elements (e.g. eye examinations, pulse, and psychophysical tests) inform the DEC Program decision making process.

Research in the DEC Program

There have only been a few research studies in which scientists analyzed the DEC Program and the studies were exclusively empirical in nature. The research conducted in relation to the DEC Program has been limited to validation of the DEC Program process. The research has been atheoretical and did not address factors related to how the DREs learn or employ the DEC Program training (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Compton; 1986; Preusser, 1992: Heishman, Singleton & Crouch, 1996, 1998; Shinar & Schechtman, 2005; Walden, 2005). Previous research included controlled laboratory studies as well as field studies. The results of the studies showed that when DREs are properly trained they could recognize general impairment and, in some cases, classify the category of drug or drugs that is responsible for the impairment (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Heishman, Singleton & Crouch, 1996, 1998; NHTSA, 2007). A more recent validation study, using only Texas enforcement data, which was gathered from NHTSA's national DRE tracking program, showed that the accuracy rates for Texas DREs in the field were less than that posted in previously published research.

Walden's (2005) research recommended further examination as to the factors which impact the DRE's decision making procedures. In order to build on the previous research, the researcher wanted to examine how individual factors or the combinations of those factors influence the DRE's decision-making process.

Table 6. Summary of DEC Program Validation Studies

Year	Researchers	Type of Data	Purpose of the Study
1985	Bigelow, Bickel, Raoche, Liebson, & Nowowieski	Lab	Original study conducted at John Hopkins; To gain controlled experimental data concerning procedures promoted and used as a technique for detecting drug intoxicated individuals and the type of drug producing the intoxication.
1994	Adler & Burns	Field	Arizona Field Study; To study the entire work product of an established DRE Program; To evaluate the validity of the DRE methodology; To examine relationships between signs, symptoms, and drug presence; To study arrest characteristics and their drug choices;
1996	Heishman, Singleton, & Crouch	Lab	To determine the validity of the variables of the DEC evaluation in predicting whether subjects had been administered ethanol, cocaine, or marijuana; To determine the accuracy of DRE predictions; To determine which variables in the DIE support accurate decisions according to drug category;
1998	Heishman, Singleton, & Crouch	Lab	To determine the validity of the variables of the DEC evaluation in predicting whether subjects had been administered alprazolam, d-amphetamine, codeine, or marijuana; To determine the accuracy of DRE predictions; To determine which variables in the DIE optimize accurate decisions according to drug category;
2002	Smith, Hayes, Yolton, Rutledge, & Citek	Field	To evaluate the DRE's ability to detect drug impairment and identify the responsible drug category based on limited data from a simulated DIE (without information from the arresting officer or interview with the subject);
2005	Shinar & Schechtman	Lab	To evaluate DRE's ability to detect drug impairment and identify the drug category responsible for the impairment on the sole basis of observable signs;
2005	Walden	Field	To determine if the accuracy rates in Texas were consistent with those experienced in the lab studies; To validate the Texas DEC Program;

Initial Research Intended to Validate the DEC Program's 12-Step Process

The original research was undertaken in a laboratory environment and was intended to validate the procedures developed by the LAPD (Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985). A follow-up field study was conducted in conjunction with the State of Arizona's Department of Public Safety's Crime Laboratory and their Governor's Office of Highway Safety (Adler & Burns, 1994). The field research examined the ability of DREs to assess drivers suspected of being under the influence of a drug or drugs and identify the impairing substance according to the seven drug categories detailed in the DEC Program.

Original John Hopkins Study. The researchers conducted a laboratory study at John Hopkins and examined if the LAPD procedures were a valid process for detecting drug intoxication as well as identifying the classification of the drug producing the intoxication (Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985). The drug categories examined as part of the original John Hopkins Study included marijuana, stimulants, and depressants. The evaluation process used in the study was shorter (20 minutes verses an hour in the field) and was divided into three steps: short interview, physiological tests, and field sobriety tests. The results indicated that on many occasions the subjects were identified as not intoxicated when they had received a drug, but when they were judged to be intoxicated the DREs were able to classify the drug responsible for the intoxication in 91.7% of the cases. Although the results indicate a relatively low false positive rate, the researchers asserted that there was also a degree of fallibility in the evaluation procedures which required improvement. The accuracy rates may have been greater if the DREs had used the same protocol they employed in the enforcement environment rather than the abbreviated version devised based on the researcher's time constraints.

Arizona Field Study. In order to better understand the validity of the DEC Program's 12-step process, Adler and Burns (1994) conducted a retrospective study of the entire work product of the DRE program in Arizona in order to validate the DRE's procedures in a field environment. There were 416 cases with toxicology results that indicated the presence of one or more drugs. In these instances, the DREs correctly identified at least one of the drugs reported in the toxicology results. In 85.5% of the total cases where the DRE called a drug, toxicology supported at least one of the drugs identified. In 14 cases, the DREs missed all the drugs listed on the toxicology report while 42 cases lacked positive toxicology to support the DRE's prediction. The study concluded that the DEC Program offers a valid method for identifying and classifying drug impaired drivers as well as acknowledges that there are observable signs and symptoms associated with specific drugs.

Follow-up Studies at John Hopkins. The next lab based validation studies moved beyond simple validation of the DEC Program's 12-step process. Heishman, Singleton, and Crouch (1996 & 1998) sought to validate the variables which are assessed as part of the DRE's evaluation as well as understand the impact they have on predicting intoxication and classifying a specific drug category. In the first study, the researchers examined the variables in terms of ethanol, cocaine, and marijuana. The researchers concluded that the ability of the DRE to predict the intake on these substances was optimized when they utilized between 17 and 28 separate variables (Heishman, Singleton & Crouch, 1996).

Using a discriminant function analysis, the researchers found that there were a total of 76 different variables collected as part of the 12-step process, but found that between 17-28 variables were a reasonable number by which the presence or absence of a drug could be predicted (Heishman, Singleton & Crouch, 1996; 1998). The researchers asserted that humans do not have the ability to integrate the vast amount of data associated with 76 variables in order to generate an accurate prediction.

Of the 158 valid evaluations, the DREs identified impairment in 81 cases and 75 of those cases had positive toxicology results for at least one drug (Heishman, Singleton & Crouch, 1996; 1998). These results indicate that the DREs can use the variables to detect impairment. In contrast, there were only 32 cases (44%) where the DRE identified at least one of the drug categories present on the toxicology report. The researchers concluded that based on the discriminant function analysis, the DREs could improve their accuracy in regards to classifying the drug category if they would focus on a small number of variables. The authors also advocated for a more relevant field study that could adequately test their conclusions in regards to optimal variables to consider as part of a drug influence evaluation (DIE).

In the second Heishman, Singleton , and Crouch (1998) study, the researchers examined the process validity in regards to alprazolam, d-amphetamine, codeine, and marijuana as well as focused on a subset of variables for each type of drug. The DRE's detection of impairment were consistent with the administration of any drug in 76% of the cases, but the DRE's ability to classify the appropriate drug category only matched the toxicology results in 32% of the cases (Heishman, Singleton & Crouch, 1998). Both of these studies indicate that DIE's variables alone do not permit the DRE to predict impairment and classification with the same accuracy as the previously published field study since critical preliminary evidence (interviews with the subject, driving behaviors, odor, paraphernalia, etc.) was not available to the DRE during this lab-based study. Additionally, the lab doses are much lower than those typically observed in the enforcement environment. Even with those limitations, the researchers concluded that the DEC Program's 12-step process is a valid tool to identify recent drug use.

Recent Validation Studies

In the most recent studies, researchers re-examined existing data from a previous laboratory study and state specific field data which was collected via the DEC Program's database. Shinar and Schechtman (2005) used data from a previously published validation study to evaluate the ability of the DRE to detect drug impairment and identify the category responsible for the impairment on the basis of observable signs alone. The results indicated that DREs had a better than chance opportunity to detect impairment with a 72% sensitivity rating. Unfortunately, the specificity was 43% with a false alarm rate of 57%. The researcher also reported that the DREs chose two categories in 50% of the cases. (Note: Lab studies related to the DEC Program only dose subjects with a single drug category.) Cannabis combined with narcotic analgesics and cannabis combined with depressants accounted for more than 60% of these combination predictions. Interestingly, narcotic analgesics and depressants were commonly confused with cannabis in those cases where the DRE incorrectly identified the drug classification.

The DREs relied on the results of all the standardized field sobriety tests (horizontal gaze nystagmus, walk-and-turn, one-leg stand, and Romberg balance test) to determine if a subject was impaired (Shinar & Schechtman, 2005). In contrast to that holistic approach, when the DREs attempted to classify intoxication according to a specific drug category, they seemed to rely on only one or two pivotal variables to guide them in their decision-making. Although this approach may simplify the DRE's task, such heuristics are not sensitive enough to the complexities of drug effects and, consequently, may lead to erroneous predictions on the part of the officer.

The more recent studies were completed in a laboratory setting with a larger number of subjects and DREs Most of the recent research has been published in peer reviewed journals as opposed to only through technical reports as part of federally funded validation projects (Heishman, Singleton & Crouch, 1996, 1998; Shinar & Schechtman, 2005). All of these studies analyzed the accuracy of the DRE in regards to identifying whether or not the subject was under the influence of a drug and, if so, which drug category was responsible for the observed impairment. As previously stated, previous researchers neglected to include any qualitative inquiry which may have enlightened the field as to why the DREs drew their conclusions in the manner they did during the studies. Additionally, the researchers failed to examine how the DREs use the DEC Program training in the field.

Texas Field Study. The most recent field study was conducted using existing enforcement evaluations from the DEC Program's national tracking database (Walden, 2005). The study was limited to Texas DIEs conducted over a two year period. In contrast to the other studies, the DIEs were limited to those where impairment had been established and only examined the ability of the DRE to accurately classify impairment according to category. Since these evaluations were conducted in the field, most indicated poly drug use, but each record was analyzed according to specific drug categories. If a DRE predicted three different drug categories, then the researcher treated each category as a separate and unique prediction. The DIEs were examined in terms of the IACP requirement for a correct prediction on the part of the DRE. These administrative guidelines indicate that if a DRE predicts one or two drug categories and at least one category is supported by toxicology results, then that DIE is consider correct. If the DRE predicts three or more categories, the toxicology results must indicate at least two of the selected categories to be considered correct.

There were 324 DIEs with associated toxicology results available for the Texas field study (Walden, 2005). Based on the analysis of category specific predictions, the DREs had a sensitivity rating of 76.7 for depressants, 38.7% for stimulants, 62.6% for narcotic analgesics, and 79.3% for cannabis (Walden, 2005). These statistics reflect the use of a complete DEC Program 12-step evaluation and efficiency rates ranging from 72.8% for depressants to a high of 82.1% for narcotic analgesics. The remaining categories, inhalants, hallucinogens, and dissociative anesthetics, did not have enough data points to provide meaningful statistics to this research.

Summary of the DEC Program's Validation Research

It is important to understand how the DEC Program's 12-step process was validated in order to analyze the variables which contributed to it. The researchers consistency indicate that the 12-step process and even subsets of that process can accurately inform the DRE so that they can detect drug impairment in both the laboratory and enforcement environments. The researchers also highlight the challenges and inconsistencies that DREs experience when trying to use the same 12-step process to classify that impairment according to a specific drug category. This issue is so prevalent that the researchers encourage the DRE to select more than one category to improve their probability of selecting a category which will be supported by toxicology results. This suggestion is buoyed by the administrative allowance for accuracy described in this section.

It stands to reason that instead of encouraging the DRE to cover their bases with a multi-category prediction, the researchers should be highlighting the results that promote a more streamlined evaluation process that focuses on a limited number of effective variables. The researchers have concluded and the HRD literature supports that DREs cannot possibly process the amount of data gathered as part of the 12-step process in order to generate an accurate classification of a drug category so they employ ill-advised heuristics to simplify the decision-making process (Dörner & Schaub, 1994; Forrester, 1961; Shinar & Schechtman, 2005). The researchers concluded that errors may be made by this individualization of the 12-step process.

Summary of Literature Review

The research that is directly related to the DEC Program was conducted in order to validate the process which DREs use to determine whether a driver is under the influence of a drug other than alcohol and, if so, identifies which drug category(s) are responsible for the impairment. In most of the studies, the researchers used trained DREs to assess subjects in controlled testing environments while two studies analyzed enforcement data collected in the field (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Compton; 1986; Preusser, 1992: Heishman, Singleton & Crouch, 1996, 1998; Shinar & Schechtman, 2005; Walden, 2005).

The researchers indicated that when the proper procedures were used, as taught in the DEC Program training, the DRE could correctly recognize impairment and then classify it according to a drug category. In contrast, the most recent study which examines existing enforcement data indicated that the percentage of correct predictions was less than previously reported. This conclusion begs the question of whether DREs, once trained, utilize the DEC Program training as taught. Furthermore, the DEC Program community needs to understand which factors (e. g. blood pressure, pupil size, or balance) or combinations of factors influence accurate predictions on the part of the DRE in an enforcement situation. The results related to these questions will serve to inform the DEC Program by highlighting potential areas where training might be improved. Additionally, a practical scenario that demonstrates how to examine how the transfer of training is linked to performance in provided in this study.

CHAPTER III

METHODOLOGY

The purpose of this study was to identify and examine those factors or combinations of factors which influence the accurate prediction of a drug category by a drug recognition expert (DRE) after he/she conduct a drug influence evaluation (DIE) in the enforcement environment. A methodological framework from which this study was designed is provided in this chapter. Mixed methods were employed so that the researcher and the consumer of this research could better understand how factors or combinations of factors might influence a DRE's decision-making process during a DIE. The quantitative and qualitative data collection was undertaken in a sequential fashion. This approach was taken so that the quantitative results, typical data analyzed as part of the DEC Program, could augment the results of the qualitative data analysis.

Introduction

The Drug Evaluation and Classification (DEC) Program's 12-step decision making process is used by the DRE to determine whether an individual is impaired and, if so, identify which drug category is responsible for the impairment through a DIE. Since the training associated with the DEC Program's 12-step process is designed to be used in an enforcement environment, it stands to reason that a study which seeks to understand that process would utilize data collected in the field. Fortunately, such data were available in the form of face sheets, standardized forms used to record the observations during a DIE, that were completed in Texas between January 1, 2002 and December 31, 2004. In order to demonstrate how this study addressed its purpose, the paradigmatic framework and research design as well as the methodological approach, research procedures, and data analysis techniques that were employed to address the questions posed in the research are discussed, namely:

1. To what extent do the drug recognition experts' (DRE) drug influence evaluation (DIE) predictions of a drug category(s) agree with the toxicology results?
2. In terms of drug categories, which factors or combinations of factors have a potential influence on the accuracy of the DRE's prediction of a drug category(s) when compared to the toxicology results?
3. Based on their experiences as DREs, what do selected DREs perceive as influencing their ability to accurately predict a drug category(s) after conducting a DIE in an enforcement environment?

"It is important that the researcher make explicit how and why the research design, sampling strategies, and data collection and analysis techniques fit the questions(s) and research context" (Miller & Crabtree, 2005, p. 623). In this chapter, the researcher presents a methodologically convincing study framework that answers the question: How was the research study designed and completed?

What was examined as well as where the study and methods are located both ontologically and epistemologically is described in this chapter. In order to accomplish this, the methodology chapter is structured in the following manner:

- Purpose of the study
- Presentation of the research questions
- Identification and description of the research inquiry paradigms which served as a framework for the addressing the research questions
- Explanation of why the methodological approach or research strategy was selected based on the nature and purpose of the study as well as the available opportunities for research
- Attention to what steps were taken or how the research methods were employed to accomplish the study including the rationale, appropriateness of the research questions to the study, and the procedures
- Demonstration of how the research will be conducted including the selection of participants, data collection, and criterion for judging data
- Explanation of the data analysis

Since most research questions are complex, "research designs inherently require multi-method thinking with particular combinations of data gathering, analysis, and interpretation approaches being driven by the research question(s) and clinical context" (Miller & Crabtree, 2005, p. 619). In order to address this challenge, different research paradigms were considered and multiple research strategies were integrated to provide the most informed responses to the research questions. The research design and procedures are organized into three distinct stages in order to effectively address the research questions.

In the first stage, the quantitative data were acquired and analyzed. During the second stage, the employment of qualitative methods was used to glean information about the DRE's perceptions. Finally, in the third stage, the researcher compared and contrasted the findings in the previous two stages in order to provide a more informed understanding of the phenomenon examined in this study.

Purpose of the Study

The purpose of this study was to identify and examine which factors or combinations of factors may influence an accurate prediction of a drug category by a DRE after conducting a DIE in an enforcement environment. In the next section of this chapter, the researcher identifies the research questions and paradigm that provide the framework for this study.

Research Questions

In order to determine which factors or combinations of factors have a potential influence on an accurate prediction of a drug category on the part of the DRE after conducting a drug influence evaluation in an enforcement environment, one must answer several questions. Since each DRE receives the same standardized curriculum, for the purpose of this study, it is assumed that the DRE uses the same 12-step decision-making process to acquire data through observations that inform their prediction of a drug category(s). Within the 12-step decision-making process, the DRE's considered multiple factors including, but not limited to, HGN, pulse, blood pressure, and pupil size.

The final step of the DIE is acquiring a biological sample (blood or urine) for toxicology analysis. Since the results of the toxicology analysis was the criterion used to determine the accuracy of a prediction on the part of the DRE, it was reasonable to assume that the DRE's prediction should be compared to the toxicology results. Based on that connection and the desire to determine which factors or combination of factors might have influenced how the DRE made an accurately predicts a drug category(s), the first of three research questions was used to assess the DRE's accuracy at the DIE and drug category levels.

Research Question One: To what extent does the DRE's DIE prediction of a drug category(s) agree with the toxicology results?

Once the researcher identified those DIEs that had accurately predicted impairment and associated it with a drug category(s), the next level of analysis was to determine which specific factors(s) (e.g. HGN, blood pressure, and pulse) may have influenced the accurate prediction on the part of the DRE. The subsequent analysis was addressed through the third research question.

Research Question One: In terms of drug categories, which factors or combinations of factors may have potential influence on the accuracy of the DRE's prediction of a drug category(s) when compared to the toxicology results?

Examining the quantitative aspects of the factors and combination of factors that may influence an accurate prediction of a drug category by a DRE after conducting a DIE only speaks to a portion of the study's purpose. In order to contribute to both the HRD and DEC Program community in a comprehensive manner, the researcher sought to understand how the DRE's experiences as a law enforcement officer and as a certified DRE may have influenced their ability to make an accurate prediction of a drug category(s) after conducting a DIE. This research question not only required deductive analysis, but also demanded the exploration and synthesis of dialogue directly from the DRE community. This need drove the development of the third research question.

Research Question Three: Based on their experiences as DREs, what do selected DREs perceive as influencing their ability to accurately predict a drug category(s) after completing a DIE in an enforcement environment?

The research questions were developed to provide the consumer of this research with two vantage points from which to understand which factors the DREs used to make accurate predictions of a drug category(s). By only approaching the purpose of this study from either a quantitative or qualitative perspective, the research would have missed the opportunity to appreciate how the DRE transferred their training into the enforcement environment.

Research Paradigms

It is helpful to understand the foundation on which a research study is built, so that the consumer of the research will be able to understand the framework and subsequent requirements of the research design and procedures. The foundation is found in the paradigmatic structure of the study. A paradigm can be described as a worldview and refers to a thought pattern in any scientific discipline or epistemological context (Schwandt, 2001). For any given problem, a paradigm frames what is to be observed, what kind of questions should be asked in relation to the problem, how these questions should be structured and how the results should be interpreted (Kuhn, 1962).

In order to address the questions posed in this study, it was important to consider the paradigmatic perspective by which the research would be conducted. Lincoln and Guba (2000) asserted that the "criteria for judging reality or validity are not absolutist, but rather are derived from community consensus regarding what is 'real', what is useful, and what has meaning (especially meaning for action and further steps)" (p. 167). The authors also note that there is a blurring of genres. Different research paradigms offer divergent lens through which we can examine a problem. So, how is reality or the pursuit of reality defined in this study? In order to answer this question, it is reasonable to examine the paradigms from which the research would be conducted. Since traditional deductive approaches do not always provide a comprehensive illustration, it is logical to consider the questions posed in this study through the eyes of different, but equally informative paradigms. In order to do this, the researcher considered paradigms that offer different pieces of the puzzle which provides, when finished, a complete image that informs the purpose of the study.

"All research is interpretive; it is guided by the researcher's set of beliefs and feelings about the world and how it should be understood and studied" (Denzin & Lincoln, 2005, p. 22). These sets of beliefs can be thought of as paradigms which are comprised based on the researcher's ontological, epistemological, and methodological perspectives and serve to guide their actions related to research (Denzin & Lincoln, 2005; Guba, 1990). The paradigms can work against and in conjunction with each other to establish different, but complimentary realities with respect to the problem being studied (Denzin & Lincoln, 2005).

Locating the Research Paradigm

There are five paradigms offered in Denzin and Lincoln's (2005) *Handbook of Qualitative Research*: positivism, postpositivism, critical theory, participatory, and constructivism. In order to address this study's research questions, it was the researcher's intention to use both deductive and interpretive approaches. An explanation of the five paradigms is summarized in the following paragraphs.

Positivism and Postpositivism

Positivism and postpositivism promote a *real* reality and demand rigor when judging quality through internal and external validity, reliability, and objectivity (Denzin & Lincoln, 2005). For this study, it was critical, given the community associated with the DEC Program, for the research results to inform the questions as to the level of predictability associated with the 12-step decision making process. From a postpositivistic perspective, reality is defined empirically through the structure of dependent and independent variables. In the case of this study, those variables were defined based on previous research validating the DEC Program.

The available opportunities for investigation did not provide for a true experimental design that offers control and manipulation of variables. The postpositivistic paradigm informs the research questions, available data, and the philosophical view of the researcher in terms of the demands of the stakeholders. The first two research questions align with the postpositivistic paradigm since they seek to explain the DRE's decision-making based on the way the variables in the 12-step process were observed and measured using pre-existing data.

It was not enough to limit this study solely to an extrinsic, empirical investigation. Since this study was centered on the use of a decision-making process acquired through a training intervention, it stood to reason that there were elements of this study that demanded more intrinsic examination with an appreciation of the values the DRE place on different aspects of a DIE. Based on Denzin and Lincoln's (2005) assertions, research must also consider the critical, constructivist, and participatory paradigms in order to offer a study that addresses the research questions in a comprehensive manner. The third research question was posed in order to explore the reality of the DEC Program's 12-step process based on what the individual DREs perceived as an influence on an accurate prediction of a drug category. Interestingly, in a typical enforcement situation, the DRE would not be aware of whether their prediction was correct until the toxicology was returned, so the DRE may have clung to a reality that is unconfirmed by empirically based data.

Critical Inquiry

Critical inquiry is based on the premise that “reality is shaped by social, political, cultural, economic, ethnic, and gender values” (Denzin & Lincoln, 2005, p. 195). Additionally, the aim of critical inquiry is to critique and transform. This study was not intended as a critique for the purpose of exposing internally inconsistent or hypocritical practices with the goal of emancipation. For this reason, the critical inquiry paradigm does not provide the appropriate perspective for this study.

Participatory

The ontology of the participatory paradigm offers a co-created reality within a complete, ordered system (cosmos) through political participation in collaborative action (Denzin & Lincoln, 2005). The quality criterion for this paradigm is if there is agreement between “experimental, presentational, propositional, and practical knowing” (p. 196). This paradigm is also interested in transformative action in service to a community of people. Although both the critical and participatory paradigms offer unique perspectives in regards to a study of the DEC Program’s 12-step decision-making process as well as its outcomes and outputs, they do not fit the aim of the inquiry based on the research questions.

Constructivism

The constructivist paradigm however, does provide a worldview that compliments the research questions. This paradigm demands that the researcher and the participants co-create an understanding or reconstruction of the problem (Denzin & Lincoln, 2005). Like the critical and participatory paradigms, constructivism provides for intrinsic, value-laden investigation that is informed by multiple voices. Constructivism promotes a dialectical methodology which requires the construction of interpretations, not in "isolation, but against a backdrop of shared understanding and practices" (Schwandt, 2001, p. 30) which cannot be duplicated through experimental and manipulative methods (Denzin & Lincoln, 2005). The results of such research are judged based on trustworthiness, credibility, and transferability. The constructivist paradigm has much to offer the researcher and stakeholders as it relates to informing the research.

Integrating Paradigms

Even though individuals construct their knowledge and reality, in the case of this study, that reality is significantly influenced by the training the DREs received as part of the DEC Program. It is likely that the training does not provide all of the elements that may impact the construction of a DRE's reality and, therefore, their ability to accurately identify individuals who are impaired along with classifying the drug category they believe to be responsible for that impairment. The impact of these other factors, such as organizational limitations, experience, general exposure to individuals impaired by drugs, and the presence of particular drugs in a particular enforcement area, on the

DRE's ability to construct an accurate prediction may not be acknowledged if the study employs a postpositivistic approach using only quantitative methods.

It is important to recognize the need to examine the data using quantitative and qualitative methodology. The community which the DEC Program operates in demands a postpositivistic paradigm, but it needs to recognize that humans are involved with the collection and interpretation of data collected during a DIE. There may issues that drive which factors or combinations of factors influence the DRE's prediction of a drug category(s) that are not readily apparent in the empirical data. Based on the need to inform stakeholders with the most complete data possible, the researcher examined the extent by which the DRE used the factors associated with the DEC Program's 12-step decision-making process through two separate postpositivistic, but complimentary lens: quantitative and qualitative. A summary of how the postpositivistic paradigm was used to explore the DEC Program's 12-step process though a mixed methods approach is provided in Table 7.

Table 7. How Postpositivism Was Used to Explore the DEC Program's 12-step Decision-Making Process

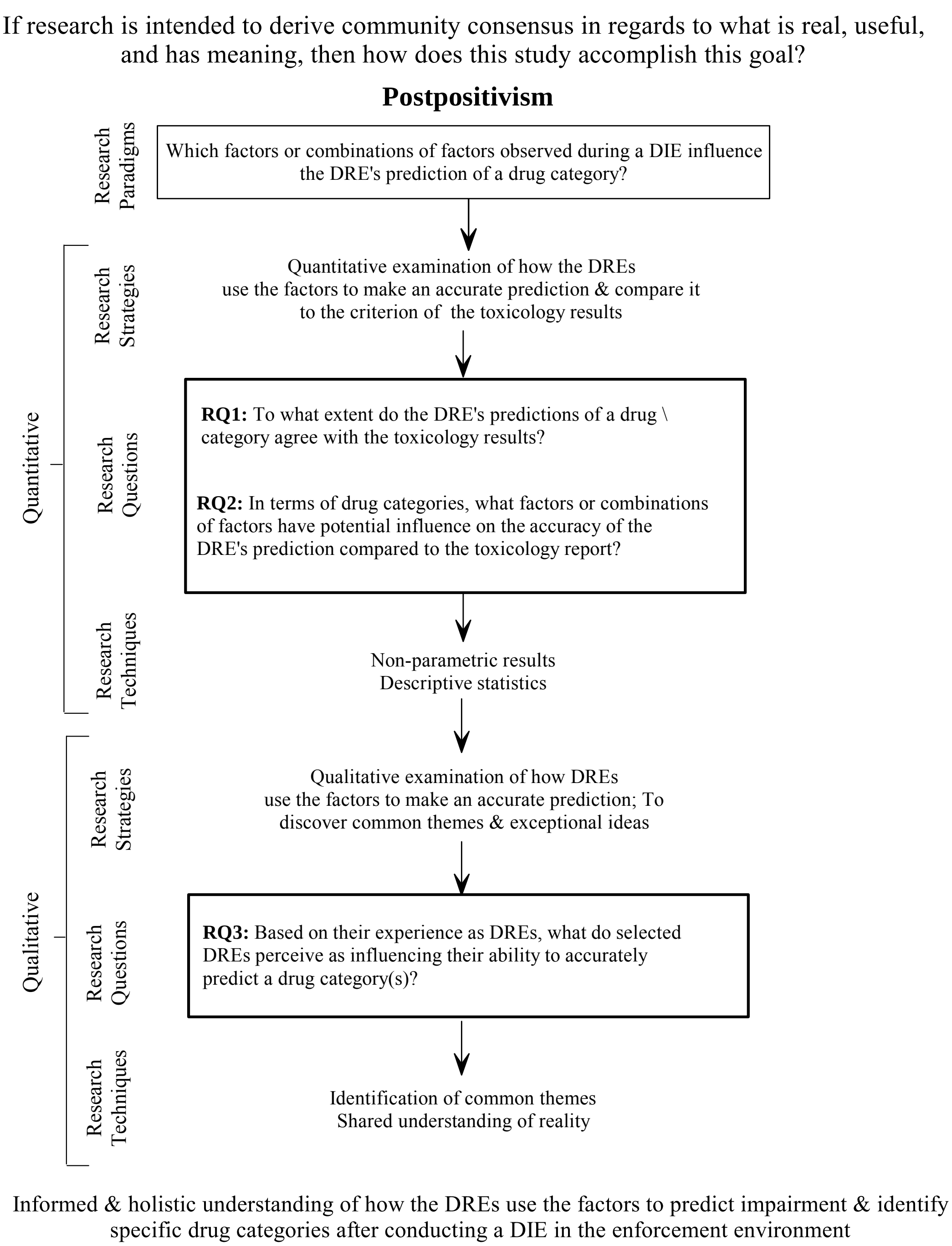
	Definition	Postpositivism	Comments
Ontology	The concepts that constitute the reality according to a specific paradigm	Probabilistically apprehensible to build on previous empirical research used to validate the DEC Program	Integrate mixed methods to determine how the perspectives of the selected DREs can inform the empirical results
Methodology	The process of inquiry according to a specific paradigm	Hypotheses tested through modified experimental design; May use quantitative and qualitative methods	The voice of the DRE is an integral part of the otherwise empirical study
Inquiry aim	Based on the paradigmatic framework, the type of questions the study is trying to answer	Prediction and control to inform the DEC Program	Understanding and reconstruction to inform the DEC Program
Quality criteria	Methods by which the data will be judged as sufficient in general and specifically related to the study	Address external and internal validity, reliability, objectivity to satisfy potential stakeholders	Only complete DIEs were included in the study and care was taken to perform member checks
Voice	Perspectives; points of view; "angles of vision" (Denzin & Lincoln, 2005, p.5);	Informer of decision makers associated with the DEC Program	Facilitated of multi-voice reconstruction to ensure the selected DREs had a voice in the study
Population	Stated experimental base of a research study: data, participants in interviews, etc. (Landau, 1997)	Representative sample of DIEs completed by a portion of the DRE population in Texas	Interviewed selected DREs to develop a shared understanding of the phenomena
Procedure	How the research is conducted based on the paradigmatic framework	Determine whether there is a difference between what was expected and what was observed: • Accuracy • Which factors or combinations of factors influenced predictions	Conducted interviews to verify themes identified through the empirical analysis and understand emergent themes within the qualitative data that are both common and extraneous in nature

Lincoln & Guba (2000)

Mixing Quantitative and Qualitative Methods to Gain Better Understanding

The aim of this study was to inform the research questions through the most comprehensive and practical approach available to the researcher. On the surface, it might seem that using a quantitative methodology would be adequate based on previous research related to the DEC Program. The DRE's perception of accuracy may not be consistent with the empirical viewpoint of what a correct prediction requires. If disagreement exists, there may be issues related to the transfer of training and/or the methods by which accuracy is determined. The researcher would have been remiss if the impact of the individual DRE's reconstruction of how accurate predictions are made during a drug influence evaluation was not also considered. By utilizing qualitative methodology to inform the quantitative findings, an additional view that further informs the postpositivist perspective, the study better addressed the research questions and, subsequently, the training program as well as its various stakeholders. The use of the postpositivism paradigm to address the purpose of this study and this integration is illustrated in Figure 9. The term, factor, is referenced in this figure and is intended to represent those factors or a combination of factors which are observed throughout a drug influence.

Figure 9. Integration of Postpositivistic Paradigm Framework and Mixed Methods to Understand How DREs Used Factors to Make Accurate Predictions



Once the research paradigm for this study had been established, the next step was to explain why these frameworks were appropriate for the study. How the methodology fit the nature and purpose of the study was well as how well it was matched to the available research opportunities is detailed in the next section of this chapter.

Research Strategies and Methods

The literature informs us that the appropriate methodology for a research study depends on the nature of the problem, the purpose of the study, and the available opportunities for investigation (Isaac & Michael, 1997). The three elements are related to the paradigmatic framework selected and, in turn, how they influenced the research strategies, methods, and data analysis techniques used to conduct this study.

Nature of the Problem

Previous research related to the Drug Evaluation and Classification (DEC) Program was intended to validate the 12-step process (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Heishman, Singleton & Crouch, 1996 & 1998; NHTSA, 2007). Previous researchers did not examine how the drug recognition expert (DRE) used the training and, subsequently, other factors in the enforcement environment to identify whether an individual was impaired, and if so, which drug category(s) was responsible for the impairment. The problem not only presents an empirical process to be examined, but also imparts interpretive issues related to how the

DRE utilizes and weighs the factors as well as, possibly, how other external influences to inform their prediction of a drug category(s).

The nature of the problem plays a critical role in determining a suitable approach to a study. Since the nature of this problem presented elements that warranted analysis, which examined prediction accuracy, the study by necessity employed a deductive approach. However, a singular approach will not provide an adequate analysis. Based on the type of process and the environment in which it is employed, it is reasonable to assume that multiple factors, other than those which can be studied in an empirical fashion, may also influence the DRE's decision making process. This assumption challenges the researcher to examine the problem by looking beyond the traditional empirical data typically collected by the DEC Program through an alternative lens in order to understand how the DRE perceived their use of deductive and interpretive factors in his or her decision-making related to the DEC Program's 12-step process.

Purpose of the Study

The drug recognition expert (DRE) uses his or her training to identify whether an individual is under the influence of a drug or drugs other than alcohol. After an individual is arrested for an impaired driving offense, the law enforcement officer may, based on their observations and from the results of the breath alcohol test, request an evaluation by a DRE. The DRE will perform a 12-step evaluation to determine if the suspect is under the influence of any psychophysical drug(s), suffering from a medical problem or not impaired (NHTSA, 2007). A summary of the DEC Program's 12-step process which is subsequent to the arresting officer suspecting drug impairment and requesting the assistance of a DRE is present below:

1. Conduct a breath alcohol test
2. Interview the arresting officer
3. Preliminary examination (interview suspect and initial pulse check)
4. Eye examinations (HGN, VGN, and LOC)
5. Divided attention tests (Romberg balance, walk-and-turn, one-leg stand, and finger-to-nose tests)
6. Vital signs (blood pressure, body temperature, and second pulse check)
7. Dark room examinations (check pupil size in different lighting conditions)
8. Check of muscle rigidity
9. Check for injection sites and third pulse check
10. Interrogation, statements and other observations
11. Opinion of the evaluator (prediction of drug category(s) by the DRE)
12. Toxicology examination (urine or blood sample)

The DRE documents his or her findings on a drug influence evaluation (DIE) form called a face sheet (See Appendix A).

The purpose of this study was to examine which factors or combinations of factors are used to determine whether the suspect is impaired and, if so, which drug category is responsible for the impairment according to the field performance of certified drug recognition experts (DREs) in Texas. In order to accomplish the purpose of this study, one would need to look at the data collected on a sample of drug influence evaluations (DIEs) to determine if the DRE followed the prescribed 12-step process to predict the drug category(s) and compare the DRE's predictions to the toxicology results.

Since the DRE evaluates multiple data elements, which may be related, in the decision making process, it must be considered "that just because variables are related does not necessarily imply a cause-and-effect relationship" (Isaac & Michael, 1997, p. 55), but it is important to understand their connections. Additionally, there may be factors that impact the DRE's performance, which cannot be discovered through deductive inquiry. For that reason, mixed research strategies and methods in order to systematically address the research questions identified earlier in this chapter were utilized.

Available Opportunities

Laboratory and field validation studies were completed during the infancy of the DEC Program, but these studies did not address the decision factors associated with the DRE's standardized 12-step process. There are empirical data available related to the drug influence evaluations (DIEs) which can be analyzed to determine to what extent the factors are used by the DRE to make an accurate prediction as to impairment and the drug category responsible for the impairment. The DRE is taught to use these empirical data in conjunction with his or her experiences to identify impairment and its source, but it is important to know how they use those data to evaluate the suspect in the enforcement environment. In order to determine how the DRE uses the DEC Program training, experience, information from their environment, and organizational factors as well as the data gleaned from their DIE, it is critical to talk to the DREs about his or her decision-making process.

In the following two sections, the researcher discusses what was done to address each research question. This discussion includes methods, quantitative and qualitative, as well as specific statistics (Chi-square test, descriptive, etc.) and techniques such as semi-structured interviews and how each was used to address each research question.

Strategies for Using Mixed Methods Approach

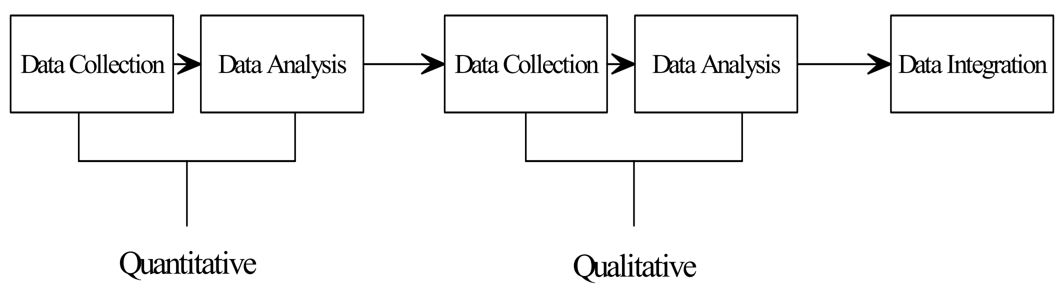
Creswell (2003) presents a decision matrix for selecting a mixed methods research strategy for inquiry. This matrix was based on four questions that address the following:

- Implementation of data collection sequence (concurrently or sequentially)
- Priority of the data (quantitative and/or qualitative)
- Integration of the data
- Theoretical framework for the research design

For the purpose of this study, the researcher took into account the intended audience for this study, faculty advisors, and previous researchers in the DEC Program. Based on those variables, a sequential explanatory strategy was employed. In order to accomplish this objective, the DRE's accuracy according to drug category had to be determined through the first research question.

In the case of the second research question, the researcher used the same set of quantitative data from the first research question to focus on those factors that, based on the frequency of occurrence, may have had an influence on the DRE's prediction accuracy. This analysis was followed by qualitative data collection to address the third research question that explored the DRE's perceptions of what influenced their predictions of a drug category(s). This sequence is consistent with the sequential explanatory strategy detailed in Figure 10.

Figure 10. Model Used for the Application of Sequential Explanatory Strategy



(Creswell, 2002, p. 213).

The priority of the data collection sequence is based on the interests of the audience, the DEC Program stakeholders, the researcher's professional association with the traffic safety community, and the faculty advisors for this study. The audience is accustomed to quantitative research, but the mixed methods approach introduced in this study will also allow the community to appreciate the manner in which qualitative inquiry can contribute to improvement by the DEC Program.

The integration of the data occurred after the quantitative and qualitative data analysis was completed based on the theoretical framework of postpositivism. This paradigm provided the foundation for the qualitative results from the third research question to inform the findings of the first two research questions that used quantitative methods. This two-tiered approach was especially useful since it provided a vehicle to use qualitative techniques to not only help to interpret the quantitative data, but also assist in explaining some of the unexpected results (Creswell, 2003; Morse, 1991). The strength of using the sequential explanatory strategy was that the approach was easy to implement and provided a practical method to inform the intended audience (Creswell, 2003). Although, the process is very time consuming due to the sequential nature of the analysis, it provided a comprehensive understanding of the problem that would not have been available if only one method had been utilized.

Methodological Approach

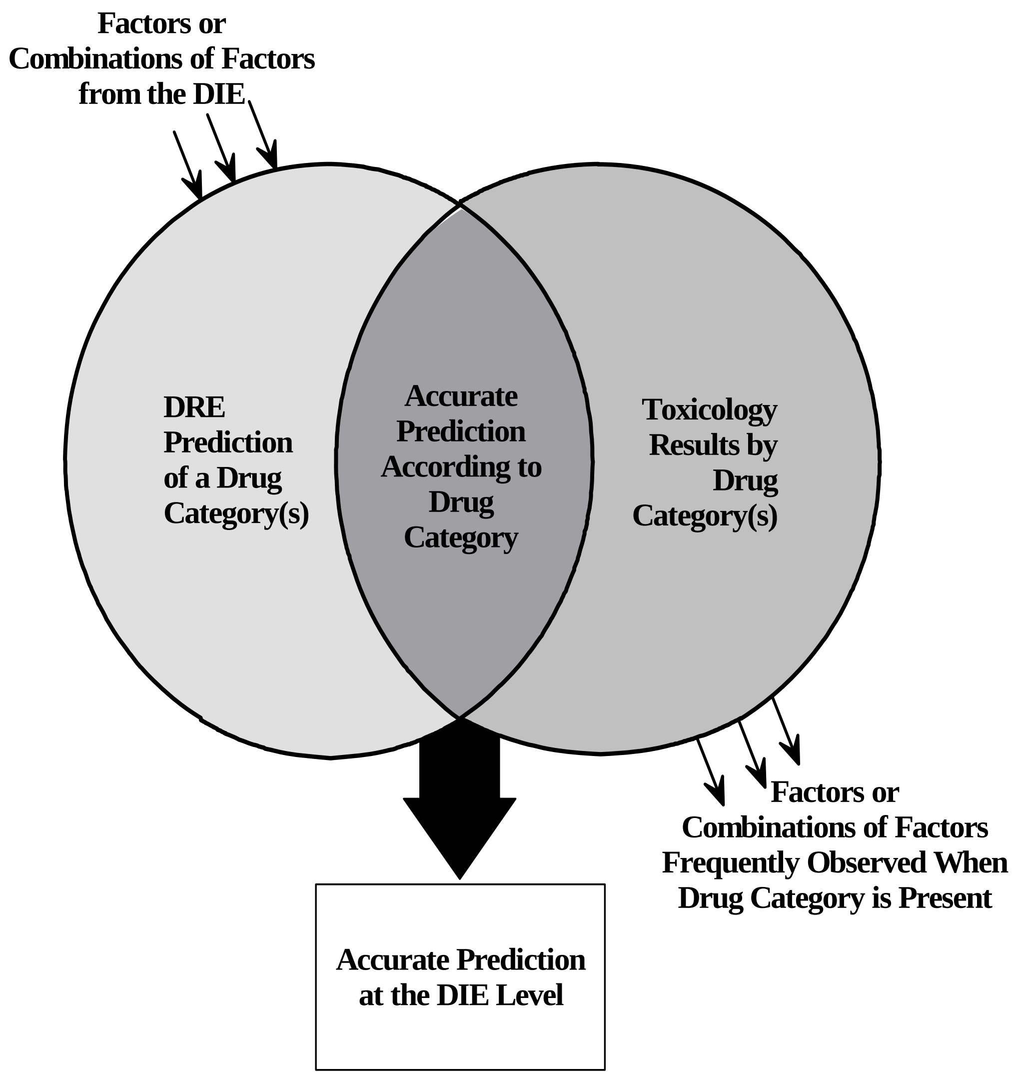
The paradigm of inquiry that served as a framework for this study and that supported the selected research strategies was presented in the previous section. In order to address the operational aspects of this study, the rationale for using the identified methodology to inform the research questions and the overall study is detailed in following section.

To determine which factors contribute to an accurate prediction of impairment as well as identify the causal drug category, the researcher had to determine which DIEs in the sample represented an accurate prediction. Through the first research question, the extent to which the DRE's prediction of a drug category(s) agree with the toxicology results based on the complete DIE and the individual drug categories was examined. The Venn diagram describing the relationship between the DRE and the toxicology results by showing the overlap between the two different data sets: DRE prediction and toxicology results; are presented in Figure 11.

The relationship between the DRE's prediction and the results of the toxicology analysis primarily at the individual drug category level is illustrated in the Venn diagram. Additionally, the figure highlights the more complex issues of an accurate DIE and the influence of the factors or combinations of factors on the DRE's prediction. The second question examined what factors or combinations of factors may have had potential influence on the accuracy of the DRE's prediction of a drug category(s) compared to the toxicology results.

Finally, the selected DREs perceptions of what influenced their ability to accurately predict a drug category(s) based on their experiences as DREs was probed in research question three. The data was sought directly from six selected DREs and the results served to provide enlightening feedback that complimented the factor related data analysis addressed in the second research question.

Figure 11. Relationship Between DRE's Prediction of a Drug Category, the Factors or Combinations of Factors Observed, and the Toxicology Results



Once it was determined to what extent the DRE predictions agreed with the toxicology results, the researcher examined which factors or combination of factors have influenced an accurate prediction according to drug category. For the purpose of this research question, an accurate prediction was defined as the intersection of the circles in the Venn diagram (See Figure 11). As discussed in the previous sections, it is important to look at these research questions from an empirical perspective. It was also critical to utilize a complimentary approach to ensure that the researcher understands the DRE decision making process from the individual DRE's constructed reality or perception and based on the experience of conducting a DIE. In order to achieve this balance, this study blended qualitative and qualitative research methodologies from the paradigmatic frameworks of postpositivism.

Rationale for the Study

Existing data from actual drug influence evaluations conducted by DREs in the enforcement environment was utilized as the data set for this study. Additionally, the individual DRE's rolling log was used to determine their prediction of a drug category(s) and the toxicology results. The data was previously collected by the Texas DEC Program coordinating organization, Sam Houston State University's College of Criminal Justice, for a project with the National Highway Traffic Safety Administration not associated with this study.

When researchers examined the relationship of a variable(s) on performance using existing data without the benefit of a control group, it is practical to rely on a causal-comparative research design (Blum & Muirhead, 2005; Creswell, 2003; Isaac & Michael, 1997). The literature informs us that casual-comparative research allows the researcher "to investigate the cause-and-effect relationships by observing some existing consequence and searching back through the data for plausible causal factors" (Isaac & Michael, 1997, p. 54). Since it is not possible to control and/or manipulate the factors which affect the DRE's decision making process in a controlled situation, the researcher restricted the data set for this study to existing data in order to discover relationships between the independent and dependent variables. By using the causal-comparative model, "useful information concerning the nature of the phenomenon: what goes with what, under what conditions, in what sequences and patterns" were uncovered (Isaac & Michael, 1997, p. 54). Although the presence of a factor(s) does not *drive* an accurate prediction (effect) in a DIE, the DRE may be influenced by specific observations of factors and, subsequently, correctly predict the drug category(s) responsible for the impairment. Using this approach, the researcher examined which factors influence an accurate prediction of a drug category based on specific data collected during a DIE.

In order to explore other factors which impact the DRE's decision making process, it was also important to understand the officer's individual experiences (Denzin & Lincoln, 2005). The literature informs us that "research is a situated activity that locates the observer in the world" (Denzin & Lincoln, 2005, p. 3) in order to make that world more visible and transparent. This type of research provides a lens that can assist the researcher in appreciating "the meaning people have constructed, how they make sense of their world and their experiences in the world" (Merriam, 1998, p.6).

Denzin and Lincoln (2005) shared the belief that “researchers study things in their natural settings attempting to interpret phenomenon in terms of the meanings people attach to them” (p. 3). “These meaning-making activities are of central interest to constructivists, simply because it is the meaning-making/sense-making/attributional activities that shape action (or inaction).” (Denzin & Lincoln, 2005, p. 167). Flick (1998) further contended that “ the combination of multiple methodological practices, empirical materials, perspectives, and observers in a single study is best understood as a strategy that adds rigor, breadth, complexity, richness, and depth to any inquiry” (Denzin & Lincoln, 2005, p. 5). These assertions demonstrate that it is important to integrate divergent methods in order to analyze the DIE data in an effort to understand the DRE’s decision-making process as well as appropriately inform the research questions. A summary of the rationale according to each of the research questions in terms of inquiry paradigm, methodology, methods, and statistics or techniques is provided in Table 8.

Table 8. Summary of Rationale According to Research Question: Paradigm, Methodological Purpose, Methods, and Data Analysis Techniques

Research Questions	Inquiry Paradigm	Methodological Purpose	Methods (How)	Statistics/Techniques (What tools will be used)
To what extent do the DRE's predictions[1] of a drug category(s)[2] agree with toxicology results[5]?	Post-Positivist	Descriptive To determine if there is a difference between the DRE's DIE prediction[1] and the toxicology results[5] for each drug category[2] and overall	Quantitative Qualitative	Chi-square test Descriptive statistics
In terms of drug categories, which factors[3] or combinations of factors may have a potential influence on the accuracy of the DRE's prediction[4] of a drug category(s)[2] when compared to the toxicology results[5]?	Post-Positivist	Descriptive To determine what factors[3] or combinations of factors may have an influence on the DRE's ability to accurately predict a drug category(s)[2]	Quantitative Qualitative	Chi-square test Descriptive statistics
Based on their experiences as DREs, what do selected DREs perceive as influencing their ability to accurately predict[4] a drug category(s)[2] after conducting a DIE in an enforcement environment?	Post-Positivist	Descriptive To understand which factors[3] the DRE's perceives as influencing an accurate prediction[4] according to a specific drug category(s)[2]	Qualitative Interviews	Identify common themes based on the perceptions of the selected DREs as to which factors[3] influence accurate predictions[4] of a specific drug category(s)[2]

[1]DIE predictions are the identification of a specific drug category based on the DRE's observations
[2]The DEC Program divides specific drugs into seven different drug categories based on the signs and symptoms which can be observed during its 12-step process –drug categories include: depressants, stimulants, hallucinogens, Disassociative anesthetics, narcotic analgesics, inhalants, and cannabis
[3]Factor or combination of factors are the results of standardized tests such as horizontal gaze nystagmus, walk-and-turn and/or one-leg stand or the results of clinical observations such as blood pressure, pulse, coordination and/or pupil size
[4]An accurate prediction occurs when the toxicology results confirm the presence of a substance included in one of the DEC program's seven drug category which has also been identified by the DRE
[5]Toxicology results are received by the DRE and entered on their rolling log which also contains their original predictions
Additional note: For the purpose of this study, the DIE was performed in the enforcement environment not as part of a training activity.

Paradigmatic Framework

To what extent did the DREs DIE predictions of a drug category(s) agree with the toxicology results was addressed through the first research question. This question was posed from a postpositivist paradigm based on the availability of previously collected, quantifiable DIE data that had been used on projects that was supported by a Texas Department of Transportation (TxDOT) and/or National Highway Traffic Safety Administration (NHTSA) funding. Although this study is in no way connected to those projects, the existence of those projects and the availability of the data associated with those projects provided an easily accessible data set to analyze as part of this study.

Though the second research question, the researcher sought to identify which factors or combinations of factors may have had a potential influence on the accuracy of the DRE's prediction of a drug category(s) when compared to the toxicology results. This question was also examined based on a postpositivistic paradigm, but was complimented by the constructivist inquire associated with the third research question. As a follow-up to the previous two research questions, the researcher used to the third research question to explore what selected DREs perceived as influencing their ability to accurately predict a drug category(s) based on their personal experiences as a DRE. Since the researcher was seeking direct experience with the phenomenon of the DRE's decision-making process through the application of their training in the enforcement environment, it was practical to interview individual DREs and develop a shared understanding of their perceptions and experience.

Methodological Purpose

The methodological purpose of the first research question was to describe the level of accuracy associated with the DRE's prediction of a drug category(s) and the presence of that drug category(s) in the toxicology results. This purpose has two tiers. The first is to look at the overall accuracy in regards to the whole DIE: Based on the complete DIE, how accurate, when compared to the toxicology results, was the DRE when they predicted drug categories? On the second tier, the research determined how accurate the DRE was based on the individual drug category regardless of the involvement of other categories. This level of analysis paved the way for the second research question which used the same data set to examine if specific factors may have had an influence on an accurate prediction on the part of the DRE.

The methodological purposes used to address all of the research questions are descriptive in nature since they describe the basic features of the data utilized in the quantitative analysis in this study (Trochim, 2006). Descriptive methods were used in a literal sense to systematically describe situations, processes, or events (Isaac & Michael, 1997). By using a descriptive approach, the researcher simplified large amounts of data from the DIEs and presented it in a practical manner that allowed the reader to understand the accuracy of the DRE in the enforcement environment (Trochim, 2006). Additionally, comparisons were made between factors, in the second and third research questions, so that the results could be used to benefit the DEC Program as well as HRD in terms of the impact that the transfer of training has on performance.

Methods and Rationale

Data is considered quantitative if it is in numerical form, but the quantitative data collected as part of this study is based upon qualitative judgments so it is important to use both methods to analyze that data (Trochim, 2006). Denzin and Lincoln (2005) assert that qualitative implies an emphasis on the qualities of entities and their processes in order to find meaning in terms of context. These qualities cannot be measured in terms of quantity or frequency. For these reasons, the first and second research questions will concentrate primarily on the accuracy rates and frequency of occurrence of specific factors, measureable variables, when a drug category was present in the toxicology results. Meanwhile, the third research question focused on the use of qualitative, semi-structured interviews to glean a better understanding of the complexities of how specific factors or combinations of factors may influence the DRE's accurate prediction of a drug category(s). This approach allowed the researcher to become more experienced with the phenomenon of interest and informed the empirical results discovered in the second research question (Trochim, 2006).

The procedures for the selection of participants as well as data collection and analysis are discussed in the next section of this chapter. The discussion is organized according to the three research questions and followed by a description of how the results were reported in Chapter IV.

Procedures

Procedures provide rules for practice or a process in a research study. Procedures define and describe how the researcher intended to conduct the research by identifying the methods, selecting the participants, collecting and analysis of data as well as ensuring the integrity of the records. The specific procedures associated with this study on the explanation are presented according to each research questions are addressed in the following section.

Research Question One

To what extent do the DRE's DIE predictions of a drug category(s) agree with toxicology results was an inquiry into process accuracy. This question was addressed by assessing the ability of the DRE to accurately predict drug categories across the DIE as well as at the individual drug category level,

Identification of Available Data

In order to answer the first question, the researcher submitted a formal request, as part of a TxDOT traffic safety project evaluation, to the Texas DEC Program's State Coordinator at Sam Houston State University's College of Criminal Justice to acquire individual DIEs and the associated rolling logs. The data was reviewed to determine which DIEs met the criteria for inclusion in the study. These criteria included the following:

- DIE was conducted as part of an enforcement evaluation (not a training evaluation)
- DIE was completed between January 1, 2002 and December 31, 2004
- DIE was completed according to DEC Program's 12-step process
- DIE did not result in an alcohol or medical rule-out
- DRE's prediction was recorded on the rolling log
- Toxicology results were recorded on the rolling log

Selection of Participants for Research Question One

The study population was selected police officers from Texas who are currently certified as drug recognition experts (DRE) according to the DEC Program's State Coordinating agency, Sam Houston State University, as well as the International Association of Chiefs of Police (IACP) that manages the program at the national level on behalf of NHTSA. It should be noted that there are approximately 300 DREs currently certified in Texas. The number of DREs represented in this study was dependent on whether the DRE participated in the voluntary submittal of drug influence evaluation (DIEs) documentation associated with arrests made between January 1, 2002 and December 31, 2004. This voluntary submittal was part of a project sponsored by the NHTSA to populate a national DRE tracking database and is not connected with this study.

Data Collection for Research Question One

Data from 199 DIEs was included in this study. The individual DIE was examined according to the training protocol detailed in the DEC Program curriculum. Each DIE was coded according to the presence or absence of factors or combinations of factors (e.g. leg tremors, slurred speech, and marked reddening of the conjunctiva). Other indicators which demand the DRE to discern between a normal range, below normal, or above normal (e.g. blood pressure, body temperature, and pupil size) were scored with a zero for normal, a one for below normal and a two for above normal. The individual DRE's rolling log was used to determine which drug category(s) was predicted by the DRE and the toxicology results.

Ensuring Data Quality in DIEs. In order to be considered for inclusion in the data set, the DIE must be completed as part of an enforcement activity between January 1, 2002 and December 31, 2004, have a complete DIE as well as toxicology results which detail the status (presence or absence) for each of the drug categories defined by the DEC Program. A complete DIE is defined as one that contains data for all of the 12-steps in the DEC Program process. If a step was not completed or no data was recorded, the DIE was not included in the sample. Even though the use of incomplete data is an acceptable practice this situation is acceptable according to the DEC Program research (Smith, Hayes, Yolton, Rutledge, & Citek, 2002), the researcher chose to include only those DIEs with complete data to maintain consistency within the data set. As part of the DIE, the DRE must have drawn a conclusion of either no drug impairment or identify a specific drug category(s) that he or she believed was responsible for the impairment.

Those DIEs classified as medical or alcohol rule-outs were not included in the data set. The DRE's prediction of a particular drug category(s) and the toxicology results was gathered directly from their rolling log which was also be acquired through the Texas DEC Program State Coordinator.

Data Analysis for Research Question One

The accuracy of the DRE's prediction of a drug category(s) when compared to the toxicology results was analyzed at the DIE and drug category levels based on the frequency of occurrence in one of four cells in a contingency table (See Figure 12). The Chi-Chi-square test of independence was used to determine if the DRE's prediction and the toxicology results were independent. The Chi-square test is a non-parametric test that provides a vehicle to analyze frequency data (e.g. number of DRE predictions that agreed with the toxicology results) (Hinton, 2004). In the case of the data collected as part of this study, Chi-square (χ^2) tested independence by comparing observed frequencies to expected frequencies. The layout of the data may resemble a two-way ANOVA, but the data in the cells were raw numbers not means. The nature of the data is discontinuous and either a nominal or ordinal measure.

Figure 12. Extent to Which DRE Predictions Agree With Toxicology Results

Toxicology Results	Prediction of the DRE	
	Predicted by DRE	**Not Predicted by DRE**
	Quadrant I	**Quadrant II**
Present in Toxicology Results	***Predicted*** by DRE **AND** ***Present*** in Toxicology Results	***Not Predicted*** by DRE **But** ***Present*** in Toxicology Results
	Quadrant III	**Quadrant IV**
Not Present in Toxicology Results	***Predicted*** by DRE **But** ***Not Present*** in Toxicology Results	***Not Predicted*** by DRE **AND** ***Not Present*** in Toxicology Results

Chi-square Analysis. This analysis was accomplished by using a 2x2 Chi-square to examine whether there was a difference between the observed and the expected values (predictions) for each drug category as well as the overall prediction for the DIEs. The shaded areas indicate those predictions that were considered correct.

A non-parametric test, like Chi-square, is a rough estimate of confidence. Using it allows the researcher to accept data that would not be suitable for parametric tests such as t-tests and ANOVA. Chi-square's limitations are also its strength; since it is more forgiving, it can be employed in a variety of research contexts applications.

If the basic hypothesis for this research question is that the DRE's prediction is independent of the toxicology results, then we needed to have some criterion against which to compare the Chi-square value calculated from the observed and expected data. (Conner-Linton, 2003) What the researcher needed to know was the probability of getting a Chi-square value of a minimum given size even if our variables were not related at all in the larger population from which our sample was drawn. This probability depends on the degrees of freedom, which in the case of this question was (1, 1). A probability of 0.01 was used in order to make a conservative judgment of independence.

The calculated Chi-square value was compared to the critical value found in a Chi-square table (Spatz, 2001). If the calculated value exceeded the critical value, then the null hypothesis of independence could be confidently rejected. In other words, it could be concluded that the DRE's prediction and the toxicology results for each drug category and/or the overall DIE were not considered to be independent of each other.

In addition to the Chi-square analysis, descriptive statistics provided information related to demographics of the DREs who conducted the DIEs included in the study as well as DRE accuracy by drug category. These descriptive statistics were used to illustrate the diversity of the DIEs and the DREs included in this study. The results from the first research question provided the basis for additional investigation in the second research question as to the factors that may influence the DRE's accurate prediction of a drug category(s).

Research Question Two

In terms of drug categories, what factors or combinations of factors may have a potential influence on the accuracy of the DRE's prediction of a drug category(s) when compared to the toxicology results?

Selection of Participants for Research Question Two

The selection of participants was identical to the process used in research question one. The data was acquired from the same 199 DIEs used to determine accuracy for the DIEs and the drug categories. Each of the DIEs had the same factors coded.

Data Collection for Research Question Two

The data from each of the 199 DIEs was coded according to the presence or absence of factors or combinations of factors. Most of the factors were coded using a "0" for normal or not present and "1" for not normal or present. Some of the factors required more differentiation to describe the responses. Pulse, body temperature, and blood pressure were divided according to normal, up (above the normal range), or down (below the normal range). Pupil size and several other observable signs and/or symptoms were assigned a nominal value to indicate its difference from a normal state. (e.g. leg tremors, slurred speech, and marked reddening of the conjunctiva). Other indicators which demand the DRE to discern between a normal range, below normal, or above normal (e.g. blood pressure, body temperature, and pupil size) were scored with a zero for normal, a one for below normal and a two for above normal.

The factor related to the finger-to-nose test was not included since it could not be coded effectively due to the inconsistency in recording the information on the face sheet. One additional factor was added based on the information gleaned from the literature review. The three pulse measurements were summarized and coded according to three categories: normal (180-270 bpm), up (above 270 bpm), and down (below 180 bpm). The sum of the pulse factor was reported separately from the traditional DRE pulse rate factor.

Data Analysis for Research Question Two

The frequencies of occurrence were calculated for each factor based on whether the drug category was present or not. Each factor, the expected observation based on the category and the frequency of occurrence in terms of percentage were summarized by drug category and included in Chapter IV of this study. Based on the results of these calculations, the researcher highlighted observations which were consistent with the presence of that drug category as well as those results which provided unexpected data. Where appropriate, Chi-square analysis was employed to test for independence between 2 or more factors. This information is presented according to drug category in Chapter IV of this study.

Research Question Three

Based on their experiences as DREs, what do selected DREs perceive as influencing their ability to accurately predict a drug category(s) after conducting a DIE in an enforcement environment?

Selection of Participants for Research Question Three

The participants who participated in the qualitative data collection which was involved with the employment of qualitative methodology were those DREs who were selected for the interview sessions associated with the third research question. These DREs were selected based on their experience, geographic location, and agency type. The researcher interviewed six DREs from various parts of the state in order to gain a shared understanding of those factors which influence an accurate prediction of a drug category(s) on the part of the DRE. The DREs who were interviewed were purposely selected to reflect the DREs whose DIEs were included in the sample obtained from the DEC Program's State Coordinator.

Initially, the State Coordinator for the Texas DEC Program was contacted to help identify possible participants for the interviews. During that communication period, it was determined that an alternative approach would better ensure anonymity for the participants. Having worked with the DEC Program both directly and indirectly over the last seven years, the researcher asked one of the more experienced DRE's to be the initial interview. Following that interview, the participants were asked to suggest three other DREs that might have similar experiences and three who might have had different experiences. The term, *experiences,* was explained to the participant as the following:

- What type of agency the DRE was assigned (state, municipal, county, small, large, etc.)
- Experience
- Whether or not the DRE was trained as an instructor or practitioner
- Type of demographic area to which they were assigned (urban, rural, suburban)
- Area of the state (geographic area)
- Courtroom experience

The selection process was snowball and purposive based on the previously listed criteria. Based on their feedback, one of the DREs that the participant suggested might have a different set of experiences to report was selected as the next DRE to be contacted for an interview. This process was repeated until six interviews were completed. Interestingly, several DREs suggested the same names, although they sometimes were suggested as having the same experiences while others were considered to have different experiences.

Each potential participant was contacted via email to invite them to participate in the interview process. As part of the email invitation, a brief overview of the study along with the information sheet approved for use by the IRB provided as an attachment. The interview would be conducted at a location of the DRE's choice and the researcher traveled to their local area to conduct the interview. The DRE was informed that the interview would be recorded using a digital recording device and that the recording would be transcribed and coded. They were assured that the original recording would be destroyed after the study was completed and that there would be no reference included in the transcript that connected their comments to them as individuals or their agencies.

Data Collection for Research Question Three

After collecting the quantitative data, the researcher conducted on interview with each of the selected Texas DREs. These interviews concentrated on determining to what extent factors or a combination of factors, associated with the DEC Program's 12-step process, contribute to an accurate prediction of a drug category(s) on the part of the DRE. The researcher used semi-structured interview techniques to facilitate a discussion on how the DRE uses the factors or combination of factors to form a conclusion as to which drug category(s) was responsible for the suspect's impairment.

The researcher used two different approaches to inform the qualitative aspects of the third research question, what selected DREs perceive as influencing their ability to accurately predict a drug category based on their experiences as DREs in the enforcement environment when compared to the toxicology results. During the interview process, the researcher wanted to verify themes identified during the quantitative part of the analysis as well as understand emergent themes which may not have been illuminated through the empirical inquiry framework. The following primary question was posed to the six selected individual DREs who participated in this study: What factors or combination of factors do you believe influence an accurate prediction of a drug category(s) based on your experience as a DRE?

As the interview progressed, follow-up questions were posed to focus on data related to specific drug categories:

- Do you rely on any one factor or combination of factors more than another when considering each of the seven drug categories as a possible prediction? If so, why?
- What, in your experience and/or training, supports your belief that a particular factor or combination of factors is more informative for the accurate prediction of a specific drug category?
- Are there any other factors that inform your decision-making process when making an accurate prediction of a specific drug category?

Ensuring Data Quality. The researcher used a DEC Program matrix card (Appendix B) to facilitate the interview so that the DRE could recall which factors are present within a particular drug category. The interviews were recorded and transcribed. The research conducted follow-up contacts in order to complete a member check. The participants were also informed that the researcher was journaling throughout the interview process and may need to contact them again for clarification or to follow-up on comments made during other interviews related to emergent themes. This approach also assisted in the qualitative analysis. The data collected from the interviews was analyzed in order to identify common perceptions and beliefs along with divergent information. Both types of discoveries served to inform the study by either verifying existing themes or identifying emergent themes.

Protecting the Identity of the Participants. The qualitative data collected was gathered through the interviews of selected DREs in response to the third research question. The interviews were transcribed and reviewed to determine whether any information could have been directly attributed to an individual DRE, suspect, law enforcement agency, or a particular case. This type of information was excluded from any documentation or analysis due to issues of confidentiality. The only information which was considered for analysis was directly related to the 12-step process, training, law enforcement experience relative to drugs and/or alcohol, and identification of impairment. Each participant was provided an opportunity to review their interview transcript to ensure accuracy.

Data Collection Process. Each interview was audio recorded via a digital recorder so that it could be easily transcribed after being transferred to MP3 files on the researcher's computer. All of the interviews were conducted at a location that was convenient and comfortable for the participant. Four of the six interviews were conducted in a neutral location in the community where the DRE worked. The other two were conducted in their offices.

Immediately after each interview, the researcher scheduled time to reflect on the interview and add detail to the notes taken during the interview. It was found it very difficult to take specific notes during the actual interview, because it seemed to take away from the communication with the participant. Since the questioning was not intended to be very structured, it was important to tune into what the participant was saying so that follow-up questions could be used to clarify information. Based on this participant selection process, the researcher was able to capture some rich information related to the DRE's perceptions of what factors or combinations of factors might influence their decision-making process during a DIE.

Data Analysis for Research Question Three

The data analysis portion of the study began with the transcription of the interview tapes. After the transcription was completed and member checks were fulfilled, the researcher divided the qualitative data into units for further analysis. The analysis processes have been detailed in the following sections.

Transcribing the Interviews. Each of the interviews was transcribed directly into MS Word from the digital recordings with an effort to transfer the discussions as closely as possible to the original conversation. Filler words such as *um* or *uh* as well as any words that were repeated. After completing the initial transcription, the transcript was reviewed while listening to the recording of the interview to ensure the transcription accuracy. The transcription was then edited to remove any references to the participant and/or their agency, any other individual or agency, as well as any other information that could link the interview with the individual participant. This version was saved as the base file. This base file was further edited to correct gross grammatical errors and added any information that may help to clarify the interview comments after the data was divided into segments. Any added comments were contained in and designated by brackets. After transcribing, reviewing and editing the interview documentation, the updated file was forwarded to each of the respective participants for review and comment.

Data Analysis Process. The data analysis was conducted using the base transcripts with the member-check comments included for the one interview where the participant added clarifying commentary. Since these files were already documented in MS Word format, it was easy to change the layout from the common 8.5” x 11” size to the 3” x 5” index card size. After this transition was complete, the data in the transcripts was divided into units and assigned to a card. Each unit of data was divided onto separate index cards and numbered. This process was repeated for each of the six interviews. The numbering sequence began with the first interview and continued through each of the subsequent interviews. Additional information was added to the header on each card to provide interview specific identifiers: interview number, data, and instructor or practitioner designation. The data units were broken down to the smallest, meaningful components. Duplicate cards were created for longer quotes that struck the researcher as significant during the interview or transcription process. These duplicates were set aside for later review.

Validating the Accuracy of the Findings. The concept of *validating* qualitative data is frequently described in terms such as *trustworthiness*, *authenticity*, and *credibility* (Creswell, 2003; Creswell & Miller, 2000; Lincoln & Guba, 2000). The inquiry paradigm utilized in this study was postpositivism, so the researcher wanted to ensure that the qualitative findings were accurate from the viewpoint of both the researcher and the DRE in order that the consumer of this research could trust the results. In order to achieve this, the researcher attended to the following (Creswell, 2003):

- Member-checking – Consulted the participants to verify the specific descriptions provided during their interviews
- Use of rich, thick description – Conveyed the participants perceptions through the use of detailed quotes to ensure the individual participant's voice was heard in the results
- Present common and discrepant data – Identify data and/or factors which appeared to reflect the DRE's perceptions as well as highlight areas that contradict the quantitative data
- Triangulate different data sources – Examined qualitative data along with complimentary quantitative data to demonstrate coherent justification for the themes and subthemes

The researcher used quotations to provide a sense of presence of the DRE's voice in the qualitative results. This data combined with the researcher's interpretation of common and divergent feedback across the six DREs provides much of the narrative in Chapter V that details the qualitative findings.

Coding the Units. Once all of the transcription information was unitized on to the cards, the transcripts were printed in that format in preparation for the sorting and coding process. Initially, the cards were sorted by interview. If a card required duplication so that it could be placed in multiple categories it was marked in the top right hand corner with yellow highlighter. This indication made it easy to find all of the cards that required duplication after the initial sort was completed.

Prior to beginning the first sort of the interview data units, initial themes were singled out to serve as the subdivisions for the first sort. The preliminary themes were identified based on the literature, quantitative analysis, and the initial impressions from the interview process. These initial themes were as follows: totality of the evidence, standardized field sobriety tests, eye indicators, quality control, and vital signs. Several data units crossed over more than one theme, so the unit cards were duplicated and assigned to more than one theme. After this sort was completed, the cards were marked to indicate the theme to which they were assigned. Those units that were assigned to multiple themes were also designated as such.

The second sort was conducted within each theme. This sort allowed the researcher to see if the information within a theme was consistent. Additionally, the second sort looked for differences between instructors and practitioners as well as provided the opportunity to identify subthemes. The major themes and subthemes are illustrated through mind maps as well as discussed in further detail in Chapter IV: Results.

Summary of Methodological Approach

The purpose of this study was to identify and examine those factors or combinations of factors which may influence the accurate prediction of a drug category by a DRE after they conducted a DIE in the enforcement environment. In order to develop a holistic understanding of how factors or combinations of factors might influence decision-making on the part of the DRE, it was important to look at the problem through different methodological lens. By first defining and analyzing the accuracy of the DRE at the DIE and drug category level, the researcher was able to move on to examining how specific factors might contribute to or detract from those accuracy rates.

By looking at the potential influence of factors using quantitative and qualitative methods and techniques, the DEC Program community and HRD professionals can be informed as to how the transfer of training manifested itself in individual performance on the part of the DRE. The use of the qualitative approach, especially the use of themes and the actual words of the selected DREs who were interviewed, provided a more in-depth or shared understanding of what happens when a DRE predicts a drug category. Although the deployment of the DEC Program training is based on standardized training and processes, the individual DRE is the decision-making instrument.

Each DRE brings a different set of experiences along with relative motivation and workplace climate to their decision-making process of predicting a drug category responsible for the observed impairment. By only relying on the quantitative data, the whole picture cannot be understood. One might argue that using the sequential explanatory strategy would not provide the level of rich data that addresses the qualitative part of this analysis, but the approach was purposeful in the sense that the DEC Program has almost exclusively relied on quantitative analysis along with anecdotal evidence from personal experiences. The introduction of a more rigorous approach to capturing individual DRE experiences is new and the researcher believed that a mixed methods approach that prioritized the quantitative data was the appropriate methodology. A detailed discussion of the results from the quantitative and qualitative data analysis is provided in Chapters IV and V respectively.

CHAPTER IV

QUANTITATIVE DATA ANALYSIS AND FINDINGS

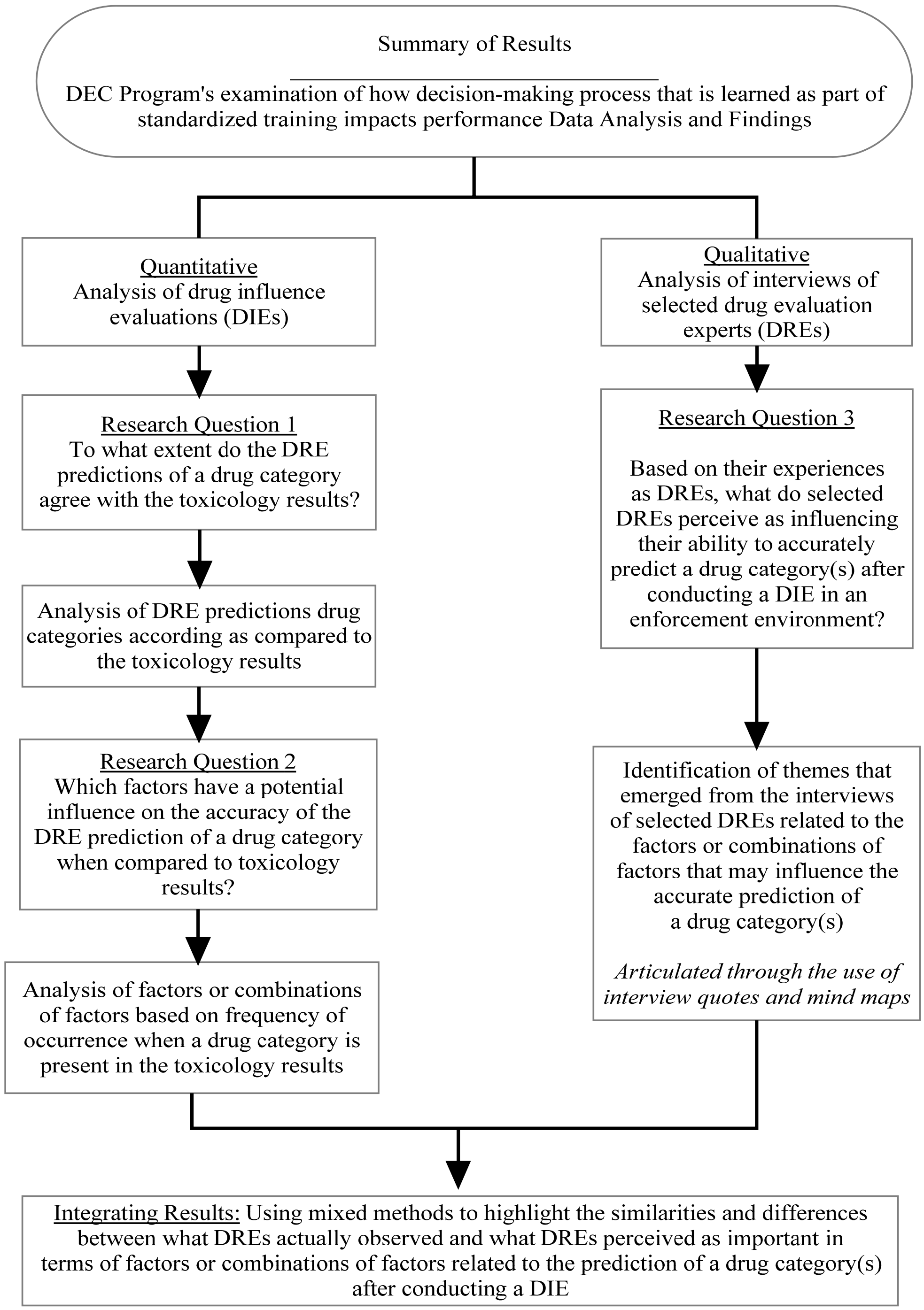
The purpose of this study was to identify and examine the drug recognition expert's (DRE) accuracy in predicting a drug category(s) and, subsequently, those factors or combinations of factors that may influence that level of accuracy after conducting drug influence evaluations (DIE) in enforcement situations. Based on the methodology explicated in Chapter III, the results of the quantitative and qualitative analysis are summarized in Chapters IV and V, respectively. The goal of Chapter IV is to present the researcher's observations and findings, so that the reader comprehends the conclusions drawn as a result of examining the following research questions in the context of the enforcement environment:

1. To what extent do the drug recognition expert (DRE) predictions of a drug category(s) agree with the toxicology results?
2. In terms of drug categories, which factors or combinations of factors have potential influence on the accuracy of the DRE's prediction when compared to the toxicology results?
3. Based on their experiences as DREs, what do selected DREs perceive as influencing their ability to accurately predict a drug category after conducting a DIE in an enforcement environment?

The structure of Chapters IV and V are framed according to the three research questions defined above. A discussion of demographics related to the officers whose

DIEs were included in the quantitative portion of this study is provided in the first section of Chapter IV. The DIEs were not selected based upon the DRE who conducted them, however the general backgrounds of the DREs who completed the evaluations included in this study were of interest. The other general point of discussion in this chapter is the definition of accuracy within the Drug Evaluation and Classification (DEC) Program. Accuracy is defined in terms of the entire DIE process as well as in regard to the prediction of individual drug categories. Following the background information, the researcher presents the results according to the research questions. The results associated with the first two research questions are addressed in Chapter IV where the quantitative results are summarized. The third research question focused on qualitative results and is discussed in Chapter V. In order for the reader to better understand the presentation of the results, the organization of the Data Analysis and Findings, Chapters IV and V, is illustrated in additional detail using a process flow that is captured in Figure 13.

Figure 13. Organization of the Data Analysis and Findings: How Quantitative and Qualitative Analysis Was Used to Inform the Research Questions



The demographics associated with the data set used in this study are discussed in the following section. Descriptive information related to the drug recognition experts (DREs) who performed the drug influence evaluations (DIEs) as well as the types of law enforcement agencies they represent is included in this section.

Demographic Data

The DIEs selected for this study were part of a larger collection of evaluations submitted to the Texas DEC Program State Coordinator at Sam Houston State University. These DIEs were collected as part of a National Highway Traffic Safety Administration (NHTSA) project used to populate a national database for DEC Program data. The DIEs were voluntarily submitted directly to the DEC Program's State Coordinator from the DREs in the state. More than 400 DIEs were considered for inclusion in this study. In order for a DIE to be included in this study, the DIE must have been completed in an enforcement situation (no training evaluations) between January 1, 2002 and December 31, 2004; toxicology results had to have been recorded on the DRE's rolling log, and the face sheet (the DIE document where factors are recorded in a standardized format) included all of the factors considered in this study. Based on these criteria, 199 DIEs were included in the study's data set.

Officers who completed DIEs that were included in the study received certification as DREs between September 1990 and July 2003. The DREs' range of experience relative to conducting DIEs in the field was between one and twenty-two years at the time the evaluation was conducted. The DREs represented law enforcement agencies that included state and local departments as well as sheriff's offices. The distribution of DREs who completed the DIEs included in this study was categorized according to the type of law enforcement agency to which they were assigned and this information is summarized in Table 9.

Table 9. Distribution of DREs Who Completed DIEs Included in This Study According to Agency Type

Agency Type	n	Percent
State	9	30.0%
Local	17	56.7%
County	4	13.3%
N	30	100.0%

Officers who voluntarily submitted the DIEs included in this study were responsible for enforcing laws in urban and suburban communities or they were assigned to a statewide agency such as the Texas Department of Public Safety. The overall population of DREs in Texas reflect a similar distribution as those who completed the DIEs included in this study. All of the DREs who completed the DIEs considered for this study were certified as practitioners at the time the DIEs were performed. Four officers were certified as DRE instructors prior to or during the data collection period (Sam Houston State University, 2006).

Discussion of Quantitative Results: Research Question One

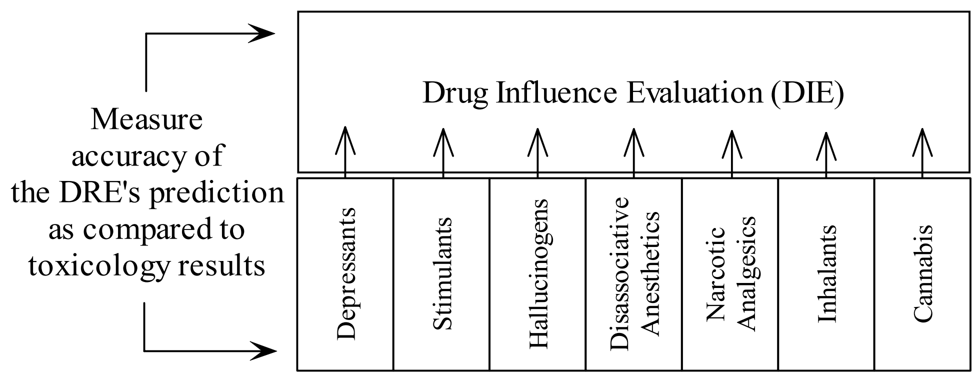
The first research question was posed in order to determine to what extent did the DRE's predictions of a drug category(s) agree with the toxicology results. In order to address that question, it is important to define what is meant by agreement.

There are several ways of defining a DRE's individual accuracy rate as well as the process accuracy in terms of the entire DIE. On the larger scale, accuracy can be defined in terms of the DIE as a whole depending on whether the DRE identified each drug category(s) indicated on the toxicology report. In order to determine whether individual factors or combinations of factors influence the accurate prediction of a drug category(s) on the part of the DRE, accuracy must also be examined within individual drug categories. The results that address both concepts of accuracy within the DEC Program are discussed in this chapter.

The DRE's Prediction

The DEC Program typically communicates accuracy rates in terms of a drug category(s). These accuracy rates are calculated at the state and national levels. The concept of accuracy is addressed specifically in the administrator's guide of the DEC Program training materials; therefore it was important to define accuracy according to the Administrator's Guide and the training materials (NHTSA, 2007). The DRE is taught to conduct a DIE by using the 12-step process and then, if appropriate, use the observations from that process to predict a drug category responsible for any impairment. The DRE uses the observations, factors or combinations of factors defined during the training, as a base to consider each category and make a conscious decision in regards to that individual drug category. Those individual decisions are combined to form the prediction at the DIE level. The relationship between DIE and individual drug categories is illustrated in Figure 14.

Figure 14. Prediction Accuracy at DIE Level Is Determined by the Accuracy at the Individual Drug Category Level



It is simple to look at the prediction of an individual drug category in isolation, however the when a subject is impaired by drugs from more than one category the DRE’s decision-making process is much more complex. Poly drug use occurs when the individual ingests more than one psychoactive drug. Alcohol is a common contribution to poly drug use in impaired drivers (Kerrigan, 2004; Levinthal, 2004; NHTSA, 2007). Since poly drug use is common among impaired drivers, it was also informative to examine all drug categories involved (Kerrigan, 2004; NHTSA, 2007). This approach provided information as to the whole picture of the individual’s impairment and how multiple drugs may interact to affect an accurate prediction on the part of the DRE. This phenomenon may have contributed to some of the inaccuracies at the individual drug category and the DIE levels.

Defining a Correct Drug Influence Evaluation (DIE)

According to the International Association of Chiefs of Police's (IACP) DEC Program Administrator's Guide (NHTSA, 2007), a candidate DRE's opinion is considered supported if the toxicological analysis discloses the presence of at least one drug category, out of a maximum of two identified by the candidate DRE. In the event the candidate DRE has concluded that three or more categories are involved, at least two of those categories must be supported by toxicology results. If the DRE predicts between four and seven categories, they only need to have two of those categories to be present on the toxicology report to be considered a correct DIE.

The IACP Administrator's Guide does not provide minimum drug confirmation criteria for DIEs for a certified DRE. Therefore, for the purposes of this study the DECP (Drug Evaluation and Classification Program) Accuracy was defined according to the same standards set forth for the candidates. In contrast, the concept of a Complete Accuracy Rate (CAR) only includes those evaluations in which each and every drug category identified by the DRE is present on the toxicology report (i.e. *no credit* for a partially correct prediction).

The distinction between the definitions of accuracy for a DIE is critical to understand especially since this study examines how the decision-making process that was learned as a part of a standardized training program impacts performance. By only considering the DECP Accuracy Rate, the accuracy was based on data that may be misleading in nature; therefore it is important to consider the rate that is accepted by the DEC Program as well as an accuracy rate that would provide a better overall understanding of the DREs' individual performance. The differences in accuracy classifications are further explained through four hypothetical examples which are provided in Table 10.

Table 10. Examples of the Difference Between DECP and Complete Accuracy

DRE Prediction	Present on the Toxicology Report	DECP Accuracy	Complete Accuracy
CNS Depressants CNS Stimulants Narcotic Analgesics	CNS Depressants CNS Stimulants	Yes	No
Cannabis PCP	Cannabis	Yes	No
CNS Stimulants Cannabis	CNS Stimulants Cannabis	Yes	Yes
Cannabis Dissociative Anesthetics Stimulants	Cannabis CNS Depressants Narcotic Analgesics	No	No

Note: The DRE prediction column represents the drugs predicted as part of the DIE and the Toxicology Accuracy column denotes the drugs identified on the toxicology report. The DECP and Complete Accuracy columns indicate whether the DRE's prediction, at the DIE level, would have been considered correct according to the specific accuracy criteria.

It should be noted that since the DECP Accuracy criteria is defined only in relation to DRE candidates, therefore the rating method may have never been intended to be used in the enforcement context (NHTSA, 2007). The DECP Accuracy definition is commonly accepted in the DRE community according to the interviews which were conducted as part of the qualitative part of this study.

Comparing the DRE's Predictions to the Toxicology Results

Based on the accuracy rating criteria detailed above, the DECP Accuracy Rate was calculated to be 88% for the DIEs included in this study. The Complete Accuracy Rate (CAR) was found to be lower at 48%. Of the 199 DIEs included in the study, only twenty-three or 12% were classified as incorrect. The DEC Program literature and analyses frequently reference the DECP Accuracy Rate by Category. However, it was also important to consider accuracy based on the CAR by category. The CAR data can translate into valuable information which could be shared in training, initial and re-certification, to highlight common errors that might not otherwise be apparent if the DEC Program only focuses on the DECP Accuracy Rate as a means of measuring performance.

DIEs Classified as Completely Correct (CAR)

There were 96 DIEs that were considered completely accurate. In 96 of the 199 DIEs included in this study, each and every drug category predicted by the DRE was present in the toxicology results. Of those 96 DIEs considered completely correct, 56

(58.3%) involved only one drug category. In other words, the DRE predicted one category and only that category was reported on the toxicology report. The Depressant and Cannabis categories represented 22 (22.9%) and 21 (21.9%) of the DIEs with only one drug category present, respectively, while Stimulants (7 or 7.3%), Narcotics Analgesics (3 or 3.1%), Dissociative Anesthetics (2 or 2.1%), and Inhalants (1 or 1.0%) accounted for the remaining DIEs. Of the 96 DIEs considered completely accurate, 40 involved more than one drug category including:

- Thirty DIEs involving Depressants with other drugs including Narcotics Analgesics (20) and Cannabis (12)
- Twenty-three DIEs involving Narcotic Analgesics with other drugs including Depressants (17) and Cannabis (5)
- Twenty-four involving Cannabis with other drugs such as Depressants (12), Dissociative Anesthetics (5), Narcotic Analgesics (5), Inhalants (2), and Stimulants (2)

DIEs Classified as Correct According to DECP Accuracy Criteria

Eighty additional DIEs were considered correct according to DEC Program's administrative standards. Of that group of 80 DIEs, twenty-three DIEs only predicted Depressants while Narcotic Analgesics (9) and Cannabis (6) were also present in the toxicology results. In approximately 25% of these DIEs, DREs did not recognize Cannabis and 34% did not recognize Narcotic Analgesics in those 80 DIEs that were considered correct. It should be noted that depending on the type of test, Cannabis could be present on the toxicology results as a metabolite. In the case where only a metabolite is present, the subject may have ingested cannabis, but the drug may not have been psychoactive in the individual's system at the time of the evaluation.

DIEs Classified as Incorrect

Of the 23 DIEs classified as incorrect, most involved a single drug category (14) and, of those, ten toxicology reports showed no drugs in the subject's system. Of those categories that were predicted, but not confirmed based on the toxicology results, Depressants (10), Cannabis (9), and Narcotic Analgesics (7) represented the most incorrect predictions on the part of the DRE.

Considering the results of the analysis associated with the first research question, that examined the extent to which DRE's made accurate predictions, several other follow-up issues were identified for further investigation. The researcher wanted to investigate the following:

- Which factors and/or combinations of factors have potential influence on the DRE's decision to predict a particular category(s)?
- What factors were observed consistent or inconsistent with the category(s) present on the toxicology report?
- Did the subject admit to taking a drug in that category?
- Was a drug present in the subject's system, but may not have been observed to be psychoactive at the time of the evaluation?

These questions are compelling issues that were addressed through the analysis of subsequent research questions.

DRE Accuracy According to Category

The DEC Program declares a DRE’s prediction as accurate if he or she identifies at least one drug category if no more than two drugs are present in the toxicology results as well as if the DRE identifies at least two drug categories if three or more drugs are present in the toxicology results. Based on the guidelines DEC Program for accuracy (NHTSA, 2007), the DRE may be motivated to select more than one category to increase their chances of classifying their overall DIE as correct. In contrast to this assumption, the DREs who completed the DIEs included in this study did the opposite. Of the 199 DIEs, 55.8% identified only one drug category in their prediction, while 36.2% of the toxicology results indicated only one drug category. In was interesting to see the distribution between the numbers of DIEs where the DRE predicted a number of drug categories and compare it to the number of drug categories present in the toxicology results. The distribution of these DIEs is detailed in Table 11.

Table 11. All DIEs: Number of Categories Predicted Compared to the Number of Categories Present in the Toxicology Results

Drug Categories Present on Toxicology Results	DRE Predicted Number of Categories: 0	1	2	3	Total
0	1	10	2	1	14
1	1	58	13	1	73
2	0	33	35	0	68
3	0	9	15	15	39
4	0	1	3	1	5
Total	2	111	68	18	199

Note: All 199 DIEs reviewed as part of this study are included in this table.

Table 11 was intended to only compare the number of categories predicted and the number of categories present, therefore accuracy is not a factor in this or subsequent tables conveying similar information. It is interesting to note that of those DIEs that were considered completely correct (DRE predicted each of the drug categories present in the toxicology results), the DREs performed better when there was only one drug category involved. This observation is consistent with the information presented in the DEC Program training materials and previous research aimed at validating the program (Adler & Burns, 1994; Bigelow, Bickel, Raoche, Liebson, & Nowowieski, 2005; Heishman, Singleton, & Crouch, 1996 & 1998; NHTSA, 2007). Both the Depressant and Cannabis categories accounted for 38.2% each of the 55 DIEs in which one category was called and that specific category was confirmed. Additional details related to this accuracy classification category are summarized in Table 12.

Table 12. DIEs Considered Correct According to the Complete Accuracy Rate: Number of Categories Predicted Compared to Number of Categories Present

Drug Categories Present on Toxicology Results	DRE Predicted Number of Categories: 0	1	2	3
0	1	0	0	0
1	0	55	0	0
2	0	0	26	0
3	0	0	0	14
4	0	0	0	0

In regards to those DIEs that were considered correct according to the DECP Accuracy Rate, the DREs who selected one drug category were correct in 99 of the 176 cases. This represents 56.2% of the DIEs included in this confirmation classification. If the DIEs with two drug categories predicted were included, the number of correct DIEs in this classification increases to 160 out of 176 cases or 90.9%. The comparison between the number of categories predicted and those present on the toxicology report when the DIE is considered correct according to the DEC Program's criteria is provided on Table 13.

Table 13. DIEs Considered Correct According to the DECP Accuracy Rate: Number of Categories Predicted Compared to Number of Categories Present

Drug Categories Present on Toxicology Results	DRE Predicted Number of Categories: 0	1	2	3
0	1	0	0	0
1	0	55	10	0
2	0	33	34	0
3	0	9	14	15
4	0	1	3	1

Of those DIEs that were classified as incorrect, the majority of the DREs predicted one or more categories and either no drugs were present (12 occurrences) or the category(s) predicted was not present in the toxicology results. Of those cases where no drugs were found according to the toxicology analysis, the DRE incorrectly predicted Cannabis in 75% of the cases where no drugs were present. A summary of the incorrect predictions is provided in Table 14.

Table 14. DIEs Considered Incorrect: Number of Categories Predicted Compared to Number of Categories Present

Drug Categories Present on Toxicology Results	DRE Predicted Number of Categories: 0	1	2	3
0	0	10	2	1
1	1	3	3	0
2	0	0	1	0
3	0	0	1	1
4	0	0	0	0

Classifying the Data

In order to examine how the factors or combinations of factors influence an accurate prediction on the part of the DRE, the data must be repeated according to individual categories. This separation is consistent with not only the manner in which the training is delivered and the decision-making process, but it is also consistent with the methodology utilized in previous research studies related to the DEC Program (Adler & Burns, 1994; Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Heishman, Singleton, & Crouch, 1996 & 1998; Walden, 2005).

In order to classify the results, the frequency data for each drug category was assigned to one of four quadrants of a contingency table. This data assignment provides a visual, easy to understand illustration of how effective the DRE was, given the information provided on the DIE in distinguishing which category the suspect was under the influence of at the time of the evaluation (NHTSA, 2007). The four quadrants related to the DEC Program decision-making process are detailed in Figure 15.

Figure 15. Contingency Table Comparing the Frequency of the DRE Prediction and the Toxicology Results

	DRE Predicted	DRE Did Not Predict
	Quadrant I	Quadrant II
Present in Toxicology Results	***Predicted*** by DRE **AND** ***Present*** in Toxicology Results	***Not Predicted*** by DRE **BUT** ***Present*** in Toxicology Results
	Quadrant III	Quadrant IV
Not Present in Toxicology Results	***Predicted*** by DRE **BUT** ***Not Present*** in Toxicology Results	***Not Predicted*** by DRE **AND** ***Not Present*** in Toxicology Results

Quadrant I represents what was considered an *accurate predication or correct call* since the DRE identified a drug category and the toxicology results confirmed the presence of the drug. Quadrant II represents what was considered an *incorrect prediction or call* since a particular drug category was not identified by the DRE but was confirmed in the toxicology report. There are many reasons for this situation. One problem may be that the DRE did not follow the DEC Program's 12-step process correctly or interpreted their observations properly. Conversely, there may be instances where the drug may have been present in the toxicology results, but not observed to be psychoactive in the suspect's system at the time of the evaluation or the indicators were masked by the effects of other drugs including alcohol. Quadrant III represents what was also considered an *incorrect prediction or call* due to the fact that a DRE calls the category but it is not confirmed by the toxicology results. Again, this incorrect decision could be due to officer error, or possibly the combined effects of another drug in the system of the suspect.

Quadrant IV was also considered an *accurate prediction or correct call* (also defined as a no-call) because the DRE did not predict a drug category and the toxicology report indicated that a drug from that category was not present in the suspect's system at the time the specimen was taken. In several of the drug categories, this condition was over represented, as indicated by the χ^2 value for that cell, and may provide a distorted view of the overall accuracy rate for the drug category.

There is a great deal that can be learned by analyzing both the correct and incorrect predictions related to individual drug categories and the DIEs made by DREs in the field. By reviewing the information on enforcement evaluations, trends can be indentified and the results can be presented in the DEC Program's practitioner school, instructor training/update and especially during the recertification sessions required for each DRE on a biannual basis. This data would serve to inform the DEC Program based on individual and process performance. This delivery of performance data is discussed in detail in Chapter VI. Although the analysis of the DIEs without the benefit of the video, which is frequently part of an agency's procedures, could be considered limited, the periodic analysis can provide objective and quantifiable information which can infuse the notion of continuous improvement with the individual DRE as well as in the process, organization, and community domains.

Analysis of Accuracy at the Drug Category Level

The researcher investigated those factors or combinations of factors that has a potential influence on an accurate prediction on the part of the DRE as part of addressing the second research question. The DIEs where the DRE predicted a category that was supported by the toxicology results must be identified. The first step in addressing the second research question is to determine whether the DRE's prediction is independent of the toxicology results.

Chi-square Analysis. The Chi-square (χ^2) test for independence was applied to each drug category. The test compares a set of observed data to a calculated or theoretical expected value. The expected values for each cell are not known, so they were calculated base on the observed data. If the hypothesis is that the DRE's prediction and the toxicology results are independent from each other, then the calculated χ^2 will need to be greater than the critical χ^2 (6.64) based on one degree of freedom and a level of significance of $p<0.01$.

The Hallucinogen and Inhalant categories were not included in the analysis, since there were not enough observations in those categories to make the presentation of the data useful either from an analytical or practical perspective. For the Narcotic Analgesic category and Dissociative Anesthetics categories, at least one of the cell values was less than five making the χ^2 distribution inappropriate. Summaries of the DRE's predictions by drug category and the results of the χ^2 analyses is provided in Tables 15 through 19.

Table 15. Depressant Category Chi-Square Table

Toxicology Results			DRE's Opinion: Predicted	Not Predicted	Total
	Present	O	90	16	106
		E	58	48	
		χ^2	17.66	21.33	
	Not Present	O	18	75	93
		E	50	43	
		χ^2	20.48	23.81	
	Total		108	91	199

Note: Each cell contains two numbers representing frequency (observed and expected) as well as the calculated Chi-square value for the cell.

$\chi^2_{Depressants} = \Sigma\ [(O-E)^2 / E] = 83.28$ $p<0.01$ df=1 $\chi^2_{critical} = 6.64$

Table 16. Stimulant Category Chi-Square Table

Toxicology Results			**DRE's Opinion: Predicted**	**Not Predicted**	**Total**
	Present	O	22	34	56
		E	7	49	
		χ^2	32.14	4.59	
	Not Present	O	4	139	143
		E	19	124	
		χ^2	11.84	1.81	
	Total		26	173	199

Note: Each cell contains two numbers representing frequency (observed and expected) as well as the calculated Chi-square value for the cell.

$\chi^2_{Stimulants} = \Sigma\ [(O-E)^2 / E] = 50.38$ $p<0.01$ df=1 $\chi^2_{critical} = 6.64$

Table 17. Dissociative Anesthetics Category Chi-Square Table

			DRE's Opinion		
			Predicted	**Not Predicted**	**Total**
Toxicology Results	**Present**	O	10	3	
		E	1	12	13
		χ^2	81.00	6.75	
	Not Present	O	4	182	
		E	13	173	186
		χ^2	6.23	0.47	
	Total		14	185	199

Note: Each cell contains two numbers representing frequency (observed and expected) as well as the calculated Chi-square value for the cell.

$\chi^2_{\text{Dissociative Anesthetics}} = \Sigma\, [(O\text{-}E)^2 / E]$ Not appropriate due to cell value being less than 5

Table 18. Narcotic Analgesics Category Chi-Square Table

			DRE's Opinion		
			Predicted	**Not Predicted**	**Total**
Toxicology Results	**Present**	O	49	25	
		E	22	52	74
		χ^2	33.14	14.02	
	Not Present	O	11	114	
		E	38	87	125
		χ^2	19.18	8.38	
	Total		60	139	199

Note: Each cell contains two numbers representing frequency (observed and expected) as well as the calculated Chi-square value for the cell.

$\chi^2_{\text{Narcotic Analgesics}} = \Sigma\, [(O\text{-}E)^2 / E] = 74.72$ $p<0.01$ df=1 $\chi^2_{\text{critical}} = 6.64$

Table 19. Cannabis Category Chi-Square Table

			DRE's Opinion		
			Predicted	**Not Predicted**	**Total**
Toxicology Results	**Present**	O	67	22	89
		E	35	54	
		χ^2	29.26	18.96	
	Not Present	O	12	98	110
		E	44	66	
		χ^2	23.27	15.52	
	Total		79	120	199

Note: Each cell contains two numbers representing frequency (observed and expected) as well as the calculated Chi-square value for the cell.

$\chi^2_{Cannabis} = \Sigma\,[(O-E)^2 / E] = 87.01$ $p<0.01$ df=1 $\chi^2_{critical} = 6.64$

Summary of Chi-square Analysis. Since each of the categories where the χ^2 was applied resulted in a large calculated χ^2 value, the null hypothesis that claimed no relationship between the DRE's prediction and the toxicology results can be rejected. This result seems obvious since the DRE's prediction is based on the use of a validation process know to produce a high level of accuracy at the drug category level.

Accuracy Issues According to Drug Category

In addition to the χ^2 analysis, it is important to highlight the percentage accuracy according to category since, at the state and national levels of the DEC Program, accuracy rates are often quoted when discussing individual and program performance. There are two different ways the DRE's accuracy can be interpreted within a category.

All of the cells can be considered, as highlighted in Figure 14, or we can look at Quadrants I-III. Both perspectives offer information that is useful and helps to inform the transfer of training aspects of this study.

Depressants. In the case of Depressants, the DREs predicted the category correctly 82.9% across all 199 DIEs. Looking at the instances where only Depressants were thought to be involved, that rate fell to 58.4%. This change was driven almost equally by errors due to the DRE predicting the category when it was not present (18/124) or not predicting it when it was present (16/124) in the toxicology results.

Stimulants. In the case of Stimulants, the overall accuracy rate was 80.9%. Examining only those DIEs where Stimulants were thought to be involved, sixty (60) DIEs, there were more errors than correct predictions:

- Twenty-two (22) predicted a stimulant that was confirmed by toxicology
- Thirty-four (34) did not predict the stimulants that were present in the toxicology results
- Four (4) DIEs predicted stimulants that were not present in the toxicology results

Dissociative Anesthetics. In the case of Dissociative Anesthetics, there were only 17 DIEs that had some reference to the category. The correct predictions represented ten (10) of those DIEs with four predicting the category without confirmation and the remaining three identified on the toxicology results without the DRE predicting the category's presence. Overall, the accuracy rate for Dissociative Anesthetics was 96.5%.

Narcotic Analgesics. The Narcotic Analgesics category was associated with 85 DIEs. The overall accuracy for the DREs in this category was 81.9%. Forty-nine (49) DIEs predicted the presence of the category that was confirmed by the toxicology results. Most of the errors occurred, twenty-five, when the DRE did not predict a narcotic analgesic that was reported on the toxicology results.

Cannabis. The DREs had an accuracy rate of 82.9% for Cannabis. Cannabis and Depressants were involved in at least 50% of the DIEs considered in this study. The accuracy rate dropped to 66.3% when only those cases involving Cannabis were used to calculate the accuracy rate. There were 67 DIEs where Cannabis was classified correctly and 22 additional cases where the presence of Cannabis was confirmed when the DRE did not predict it. As previously indicated, this phenomenon is not unexpected since cannabis type drugs are often identified as a metabolite according to the toxicology reports. In this situation, the DRE predicts Cannabis as being present on their rolling log, but in reality there may have been no signs or symptoms that supported the suspect as being under the influence of cannabis, since the drugs psychoactive properties had already dissipated. The accuracy rates are summarized according to drug category in Table 20.

Table 20. Accuracy Rates by Drug Category

	Accuracy Rates %
Depressants	82.9%
Stimulants	80.9%
Dissociative Anesthetics	96.5%
Narcotic Analgesics	81.9%
Cannabis	82.9%

Note: N=199 Drug influence evaluations

It should be noted that these accuracy rates take into account all four quadrants of data for each drug category. These rates are applicable if it is assumed that the DRE makes an active choice to not predict a drug category when he or she believes that it is not present in the subject's system at the time of the DIE.

The DEC Program's 12-step process is built on capturing data based on selected factors or combinations of factors gleaned from observations and assessments by the DRE. The DRE's are trained to interpret these factors according to specific drug categories. After examining the accuracy rates at the drug category level, it is logical to examine what factors or combinations of factors have the potential to influence accurate predictions on the part of the DRE when compared to the toxicology results. The frequency that factors or combinations of factors occur in comparison with accurate decisions as well as with what is expected for that drug category according to the DRE's training is explored in the following section. This analysis provides insight into the DRE's application DEC Program's 12-step decision-making process. Additionally, this quantitative analysis will serve as a comparison for the feedback received from the DREs during the interviews connected to the third research question in this study.

Discussion of Quantitative Results: Research Question Two

The second research question was formulated to identify what factors or combinations of factors have a potential influence on the accuracy of the DRE's prediction according to drug category when compared to the toxicology report. In order to address that question, it is important to determine what constitutes an accurate prediction according to a specific drug category as well as define what is meant by factor or combination of factors. A summary of the factors and their respective attributes is included in Table 21.

Table 21. Factors and Combinations of Factors the DRE[1] Considers When Predicting a Drug Category

Factor	Definition of Factor	When the factor is considered present?
BAC	BAC[2] result	BAC considered present if result is above 0.00
Pulse	Three pulse readings are taken at different intervals during the DIE[3]	Each individual pulse is considered below normal (between 60-90bpm) if the reading is less than 60bpm[4] and above normal is the reading is more than 90bpm. If any one of the three pulse readings is considered below or above normal, then the pulse is designated according to that reading (e.g. If pulse #1 is above normal, but the other two readings are considered normal then the DRE designates that subject's pulse as above normal).
Sum of Pulse Readings	Total of the three separate pulse readings. This summary factor is not usually part of the DIE process, but was the factor considered in validation research reviewed as part of this study.	The sum of the pulses is considered below normal (between 180-270bpm) if the reading is less than a sum of 180bpm[4] and above normal is the reading is more than a sum of 270bpm
Attitude	This is a subjective factor that is based on the DRE's observation of the subject's attitude during the DIE.	The factor is considered present if the DRE indicates that the subject is observed to be uncooperative, apathetic, difficult or unusually poor.
Coordination	This is a subjective factor that is based on the DRE's observation of the subject's coordination.	The factor is considered present if the DRE indicates that the subject's coordination appears to be unusually poor.
Breath	This is a subjective factor that is based on the DRE's observation of a drug related odor.	The factor is considered present if the DRE observes the odor of alcohol, marijuana, or some other chemical or drug related substance.
Face	This is a subjective factor that is based on the DRE's assessment of the subject's facial condition.	The factor is considered present if the DRE indicates that the subject's face appears to be unusually pale or flush.
Speech	This is a subjective factor that is based on the DRE's assessment of the subject's speech.	The factor is considered present if the DRE indicates that the subject's oral communication is observed to be unusually slurred or rapid.

Table 21. Continued

Factor	Definition of Factor	When the factor is considered present?
Marked Reddening of the Conjunctiva	This factor is based on the condition of the subject's conjunctiva (inside the lower eyelid).	The factor is considered present if the DRE indicates that there is marked reddening of the subject's conjunctiva in one or both eyes.
Condition of the Eye	This is a subjective factor that is based on the DRE's assessment of the subject's eye condition.	The factor is considered present if the DRE indicates that the subject's eyes appear to be unusually bloodshot and/or watery.
Eyelids	This is a subjective factor that is based on the DRE's assessment of the condition of the subject's eyelids.	The factor is considered present if the DRE indicates that the subject's eyelids appear to be unusually droopy.
HGN	The horizontal gaze nystagmus (HGN) test is an observation of the eyes while they follow a stimulus in a horizontal plane. HGN is part of the SFST[5] battery and has six clues associated with the test (up to three in each eye for a total of six). There are three tests in the HGN: lack of smooth pursuit, nystagmus at maximum deviation, and on-set of nystagmus prior to a 45^{o} angle.	The factor is considered present if the DRE indicates that there is a presence of four or more clues identified during the HGN test; there are no clues associated with this assessment.
VGN	The vertical gaze nystagmus (VGN) test is part of the SFST[5] battery and is an observation of the eyes while they follow a stimulus in the vertical plane.	The factor is considered present if the DRE observes nystagmus in the vertical plane. VGN is either present or not present; there are no clues associated with this assessment.
LOC	The lack of convergence (LOC) test is an eye test that determines whether the subject can converge their eyes while focusing on a stimulus as it is moved towards the bridge of the nose.	The factor is considered present if the DRE observes one or both eyes failing to cross inward or if the eyes cannot converge at all.
Romberg Test	The Romberg test is typically conducted when a subject is in a standing position with their eyes closed and their head tilted back slightly.	There are four individual factors associated with the Romberg Test: body sway, eyelid tremors, body tremors and the subject's internal clock. The factors are considered present if the subject sways more than 2" in any direction during the test, experiences eyelid or body tremors and/or estimates the passage of 30 seconds incorrectly. If order for the subject to estimate the passage of time (internal clock factor) correctly, they must indicate that 30 seconds have pasted between the 25 and 35 second mark of the test.

Table 21. Continued

Factor	Definition of Factor	When the factor is considered present?
Walk and Turn Test	The walk-and-turn test is part of the SFST[5] battery and has eight clues associated with the test	This factor is considered if the DRE observes any clues (loss of balance in the instructional stage, starts test too soon, stops walking during the test, steps of the line, misses heel to toe, raises arms for balance, take the wrong number of steps and/or turns incorrectly). If the subject is unable to perform the test, the DRE records the number of clues observed before the test was stopped.
One-Leg Stand Test	The one-leg stand test is part of the SFST[5] battery and has four clues associated with the test	This factor is considered if the DRE observes any clues (hopping, puts foot down, sways and/or uses arms for balance). If the subject is unable to perform the test, the DRE records the number of clues observed before the test was stopped.
Blood Pressure	The subject's blood pressure is measured using a sphygmomanometer (blood pressure cuff measurement device) to determine if it is in normal range.	The factor is considered present if the systolic reading is outside the range of 120-140 mmHg[6] and/or the diastolic is outside the range of 70-90 mmHg.
Body Temperature	The subject's body temperature is tested using an electric, oral thermometer to determine if it is in normal range.	The factor is considered present if the body temperature is outside the range of 97.6^{o} and 99.6^{o}.
Pupil Size	The DRE observes the pupil size in three different lighting conditions (room light, direct light and near total darkness).	The factor is considered present if the pupil size is outside the normal range of 3.0mm and 6.5mm in any one of the lighting conditions.
Nasal Cavity	Nasal cavity is examined for any abnormalities or signs of ingestion.	The factor is considered present if the nasal cavity is red, inflamed, there is no septum and/or drug related debris is observed.
Oral Cavity	Oral cavity is examined for any abnormalities or signs of ingestion.	The factor is considered present if there are raised taste buds, blisters, drug related debris, and/or discoloration is observed in the oral cavity.

Table 21. Continued

Factor	Definition of Factor	When the factor is considered present?
Hippus	Hippus is the rhythmic pulsating of the pupils as they dilate and constrict within fixed limits.	The factor is considered present if the DRE observes the pupil(s) pulsating (dilating and constricting) during the observation of the pupils in the different lighting conditions.
Rebound Dilation	Rebound dilation occurs when the pupils grow steadily larger on the expansion pulsations.	The factor is considered present if the DRE observes the pupil(s) grow (in a pulsating fashion) in size during the observation of the pupils in the different lighting conditions.
Reaction to Light	The pupils of the eyes are examined to determine their reaction to light when a light source is introduced.	The factor is considered present if the DRE observes the pupils having a slow or no reaction when light is introduced.
Muscle Tone	The subject is examined to determine the state of their muscle tone at the time of the DIE (usually observed on the forearm).	The factor is considered present if the DRE determines that the subject's muscle tone is normal, flaccid or rigid.
Injection Sites	The subject is examined to identify the location of any injection sites.	The factor is considered present it the DRE locates at least one injection site that is either old or new.
Subject Reported CNS Depressants	During the DIE, the subject reported taking a drug that is classified as a **Depressant** according to the DEC Program[7]	The factor is considered present if the subject admits to using a drug that is classified in the **Depressant** drug category
Subject Reported CNS Stimulants	During the DIE, the subject reported taking a drug that is classified as a **Stimulant** according to the DEC Program	The factor is considered present if the subject admits to using a drug that is classified in the **Stimulant** drug category
Subject Reported Hallucinogens	During the DIE, the subject reported taking a drug that is classified as a **Hallucinogen** according to the DEC Program	The factor is considered present if the subject admits to using a drug that is classified in the **Hallucinogen** drug category

Table 21. Continued

Factor	Definition of Factor	When the factor is considered present?
Subject Reported Dissociative Anesthetic	During the DIE, the subject reported taking a drug that is classified as a **Dissociative Anesthetic** according to the DEC Program	The factor is considered present if the subject admits to using a drug that is classified in the **Dissociative Anesthetic** drug category
Subject Reported Narcotic Analgesics	During the DIE, the subject reported taking a drug that is classified as a **Narcotic Analgesic** according to the DEC Program	The factor is considered present if the subject admits to using a drug that is classified in the **Narcotic Analgesic** drug category
Subject Reported Inhalants	During the DIE, the subject reported taking a drug that is classified as a **Inhalant** according to the DEC Program	The factor is considered present if the subject admits to using a drug that is classified in the **Inhalant** drug category
Subject Reported Cannabis	During the DIE, the subject reported taking a drug that is classified as **Cannabis** according to the DEC Program	The factor is considered present if the subject admits to using a drug that is classified in the **Cannabis** drug category
Subject Reported Alcohol	During the DIE, the subject reported consuming **Alcohol**	The factor is considered present if the subject admits to drinking **Alcohol**
Subject Reported No Drugs	During the DIE, the subject did not report taking any drug	The factor is considered present if the subject reports that they have **not taken any drug** that is classified in a drug category according to the DEC Program
DRE Predicted CNS Depressants	DRE predicted that the subject was under the influence of a drug that is classified as a **Depressant** according to the DEC Program	The factor is considered present if the DRE predicts the **Depressant** drug category
DRE Predicted CNS Stimulants	DRE predicted that the subject was under the influence of a drug that is classified as a **Stimulant** according to the DEC Program	The factor is considered present if the DRE predicts the **Stimulant** drug category

Table 21. Continued

Factor	Definition of Factor	When the factor is considered present?
DRE Predicted Hallucinogens	DRE predicted that the subject was under the influence of a drug that is classified as a **Hallucinogen** according to the DEC Program	The factor is considered present if the DRE predicts the **Hallucinogen** drug category
DRE Predicted Dissociative Anesthetic	DRE predicted that the subject was under the influence of a drug that is classified as a **Dissociative Anesthetic** according to the DEC Program	The factor is considered present if the DRE predicts the **Dissociative Anesthetic** drug category
DRE Predicted Narcotic Analgesics	DRE predicted that the subject was under the influence of a drug that is classified as a **Narcotic Analgesic** according to the DEC Program	The factor is considered present if the DRE predicts the **Narcotic Analgesic** drug category
DRE Predicted Inhalants	DRE predicted that the subject was under the influence of a drug that is classified as a **Inhalant** according to the DEC Program	The factor is considered present if the DRE predicts the **Inhalant** drug category
DRE Predicted Cannabis	DRE predicted that the subject was under the influence of a drug that is classified as **Cannabis** according to the DEC Program	The factor is considered present if the DRE predicts the **Cannabis** drug category
DRE Predicted No Drugs	DRE predicted that the subject was **not under the influence** of any drug that is classified according to the DEC Program	The factor is considered present if the DRE predicts **no drug category**
Toxicology Identified CNS Depressants	Toxicology results indicated that a drug classified as a **Depressant** according to the DEC Program was present in the specimen	The factor is considered present if the toxicology results identify a drug or its metabolites classified in the **Depressant** drug category
Toxicology Identified CNS Stimulants	Toxicology results indicated that a drug classified as a **Stimulant** according to the DEC Program was present in the specimen	The factor is considered present if the toxicology results identify a drug or its metabolites classified in the **Stimulant** drug category

Table 21. Continued

Factor	Definition of Factor	When the factor is considered present?
Toxicology Identified Hallucinogens	Toxicology results indicated that a drug classified as a **Hallucinogen** according to the DEC Program was present in the specimen	The factor is considered present if the toxicology results identify a drug or its metabolites classified in the **Hallucinogen** drug category
Toxicology Identified Dissociative Anesthetic	Toxicology results indicated that a drug classified as a **Dissociative Anesthetic** according to the DEC Program was present in the specimen	The factor is considered present if the toxicology results identify a drug or its metabolites classified in the **Dissociative Anesthetic** drug category
Toxicology Identified Narcotic Analgesics	Toxicology results indicated that a drug classified as a **Narcotic Analgesic** according to the DEC Program was present in the specimen	The factor is considered present if the toxicology results identify a drug or its metabolites classified in the **Narcotic Analgesic** drug category
Toxicology Identified Inhalants	Toxicology results indicated that a drug classified as a **Inhalant** according to the DEC Program was present in the specimen	The factor is considered present if the toxicology results identify a drug or its metabolites classified in the **Inhalant** drug category
Toxicology Identified Cannabis	Toxicology results indicated that a drug classified as **Cannabis** according to the DEC Program was present in the specimen	The factor is considered present if the toxicology results identify a drug or its metabolites classified in the **Cannabis** drug category
Toxicology Identified No Drugs	Toxicology results indicated that **no drug** classified according to the DEC Program was present in the specimen	The factor is considered present if the toxicology results identifies **no drug category**

[1]Drug recognition expert (DRE)
[2]Blood or breath alcohol concentration (BAC)
[3]Drug influence evaluation (DIE)
[4]Beats per minute (bpm) in regards to pulse rate
[5]Standardized field sobriety tests (SFST)
[6]Units for blood pressure measurement – millimeters of mercury (mmHg)
[7]Drug Evaluation and Classification (DEC) Program

(Burns, Page, & Leiken, 1998; NHTSA, 2007)

Analysis of Factors or Combinations of Factors According to Drug Category

When a DRE is trained to use the DEC Program's 12-step decision-making process, he or she is instructed to use the steps as a means to observe factors and combinations of factors and weigh those observations, based on the DEC Program training, with other evidence to predict a drug category(s) that they believe to be responsible for the observed impairment. For the purposes of this study, each factor has an expected condition based on the drug category as referenced in the DEC Program's training materials (NHTSA, 2007). Based on that expected condition, the frequency of occurrence for the each factor was calculated for when that drug category was present as well as when the drug category was not present. These results are presented in Tables 22 through 26. Selected factors for each of the drug categories where the frequency of occurrence was consistent with the expected observation when that drug category was present in the toxicology results are highlighted in the following sections.

Factors or Combinations of Factors Associated with Depressants

- There were 106 DIEs where a depressant was reported as present on the toxicology results. The Depressant category was reported as present in more DIEs than any of the other categories. There were several factors where the frequency of occurrence showed a difference between those cases where a depressant was present and those where it was not. The factors which showed a difference included: Poor coordination was observed in 85.8% of DIEs where a depressant was present on the toxicology report.

- Slurred or slow speech was observed in 77.4% of the DIEs where a depressant was present on the toxicology report as opposed to 43% of DIEs where a depressant was not present.
- HGN was observed 84% of the time when a depressant was present in the toxicology results while only 48.4% of those DIEs where depressants were not present.
- There was an average of 5.03 clues observed when a depressant was present, but only 2.75 clues when a depressant was absent from the toxicology report.
- Reaction to light was observed to be slow in 63.2% of the DIEs where depressants were present.
- When a depressant was present on the toxicology report, Narcotic Analgesics (52.8%), Cannabis (35.8%), and Stimulants (19.8%) were also found.

A summary detailing the frequency of occurrence for each factor in relation to the presence of Depressant drug category is provided in Table 22.

Table 22. Factor Frequency for Expected Observations: Depressants

Sign or Symptom	Expected Observation	Depressants % Present n=106	Depressants % Not n-93
Coordination	Poor	85.8%	65.6%
Breath	Normal	78.3%	65.6%
Condition of the face	Normal	57.8%	69.9%
Speech	Slow and/or Slurred	77.4%	43.0%
Marked Reddening of the Conjunctiva	Not Present	64.2%	34.4%
Condition of the eyes	Normal	52.8%	49.5%
Horizontal gaze nystagmus (HGN)	Present	84.0%	48.4%
Vertical gaze nystagmus (VGN)	Normal (Present-high	60.4%	81.7%/18.3%
Lack of convergence (LOC)	Present	96.2%	90.3%
Romberg - Sway	Poor Performance[1]	67.9%	43.2%
Romberg - Eye tremors	Not Present	78.3%	59.1%
Romberg - Body tremors	Not Present	92.5%	84.9%
Romberg - Internal clock	Slow	29.2%	23.9%
Walk-and-Turn	Poor Performance[1]	95.3%	81.7%
One-Leg-Stand	Poor Performance[1]	84.9%	80.6%
Condition of nasal cavity	Normal	80.2%	68.8%
Condition of oral cavity	Normal	39.6%	23.7%
Pupil size - Room light	Normal[2]	77.4%	88.2%
Pupil size - Near total darkness	Normal[2]	36.8%	33.3%
Pupil size - Direct light	Normal[2]	76.4%	82.8%
Pupil size	Normal[2]	18.9%	19.4%
Hippus	Not Present	83.0%	89.2%
Rebound dilation	Normal	82.1%	61.3%
Reaction to light	Slow	63.2%	48.4%
Condition of muscle tone	Flaccid	59.4%	32.6%
Injection sites	Not Present	87.7%	77.4%
Pulse (Sum)	Down[3]	5.7%	4.3%
Pulse (DRE)	Down[3]	4.7%	5.4%
Blood pressure	Down[4]	72.6%	25.8%
Body temperature	Normal[5]	43.4%	67.7%
Depressants are Present		100.0%	0.0%
Stimulants are Present		19.8%	37.6%
Hallucinogens are Present		0.0%	0.0%
Dissociative Anesthetics are Present		1.9%	11.8%
Narcotic Analgesics are Present		52.8%	19.4%
Inhalants are Present		0.0%	3.2%
Cannabis is Present		35.8%	54.8%
No Drugs Present			12.9%

[1] Poor coordination can translate to poor performance on the Romberg balance (sway), walk-and-turn, and one-leg stand tests.
[2] Normal range for pupil size is between 3.0 and 6.5 mm
[3] Normal range for pulse rate is between 60-90bpm
[4] Normal range for blood pressure is 120-140 mmHg (systolic) and 70-90 mmHg (diastolic)
[5] Normal range for body temperature is 98.6^{o} + or – 1^{o} F

Factors or Combinations of Factors Associated with Stimulants

There were 56 DIEs where a stimulant was reported as present on the toxicology results. There was minimal difference between the frequency of occurrence for most of the factors when comparing those DIEs with stimulants present and without. The following bullets highlight the factors which showed a difference:

- The condition of the nasal cavity was observed to be red and/or inflamed 30.4% of the time when a stimulant was present in the toxicology results.
- During the Romberg balance test, excessive sway was observed in 57.1% of the DIEs where a stimulant was present.
- The internal clock assessment, also part of the Romberg balance test, was considered fast in 33.9% of the cases where a stimulant was present as opposed to 24.6% when a stimulant was not present.
- When a stimulant was present on the toxicology report, Cannabis (50%), Depressants (37.5%), and Narcotic Analgesics (33.9%) were also found in the data set.

A summary detailing the frequency of occurrence for each factor in relation to the presence of Stimulant drug category is provided in Table 23.

Table 23. Factor Frequency for Expected Observations: Stimulants

Sign or Symptom	Expected Observation	Stimulants % Present n=56	Stimulants % Not n=143
Coordination	Poor	66.1%	80.4%
Breath	Normal	73.2%	72.0%
Condition of the face	Normal	69.6%	60.8%
Speech	Rapid	8.9%	2.1%
Marked Reddening of the Conjunctiva	Not Present	44.6%	52.4%
Condition of the eyes	Normal	60.7%	47.6%
Horizontal gaze nystagmus (HGN)	Not Present	50.0%	25.9%
Vertical gaze nystagmus (VGN)	Not Present	73.2%	69.2%
Lack of convergence (LOC)	Not Present	91.1%	94.4%
Romberg - Sway	Normal	57.1%	36.4%
Romberg - Eye tremors	Not Present	57.1%	74.1%
Romberg - Body tremors	Present	14.3%	9.8%
Romberg - Internal clock	Fast	33.9%	24.6%
Walk-and-Turn	Poor Performance[1]	83.9%	90.9%
One-Leg-Stand	Poor Performance[1]	82.1%	83.2%
Condition of nasal cavity	Normal/Red, inflamed	69.6%/30.4%	76.9%/23.1%
Condition of oral cavity	Normal/Blisters	32.1%/32.1%	32.2%/32.9%
Pupil size - Room light	Dilated[2]	3.6%	7.0%
Pupil size - Near total darkness	Dilated[2]	62.5%	60.8%
Pupil size - Direct light	Dilated[2]	0.0%	2.1%
Pupil size	Dilated[2]	62.5%	60.8%
Hippus	Not Present	85.7%	86.0%
Rebound dilation	Not Present	66.1%	74.8%
Reaction to light	Slow	62.5%	53.8%
Condition of muscle tone	Rigid	12.5%	6.3%
Injection sites	Not Present	71.4%	87.4%
Pulse (Sum)	Up[3]	42.9%	45.5%
Pulse (DRE)	Up[3]	53.6%	49.7%
Blood pressure	Up[4]	35.7%	34.3%
Body temperature	Up[5]	3.6%	4.9%
Depressants are Present		37.5%	59.4%
Stimulants are Present		100.0%	0.0%
Hallucinogens are Present		0.0%	0.0%
Dissociative Anesthetics are Present		3.6%	7.7%
Narcotic Analgesics are Present		33.9%	38.7%
Inhalants are Present		0.0%	2.1%
Cannabis is Present		50.0%	42.7%
No Drugs Present			8.4%

[1] Poor coordination which can translate to poor performance on the Romberg balance (sway), walk-and-turn, and one-leg stand tests.

[2] Normal range for pupil size is between 3.0 and 6.5 mm

[3] Normal range for pulse rate is between 60-90bpm

[4] Normal range for blood pressure is 120-140 mmHg (systolic) and 70-90 mmHg (diastolic)

[5] Normal range for body temperature is 98.6^{o} + or – 1^{o} F

Factors or Combinations of Factors Associated with Dissociative Anesthetics

There were 13 DIEs where a dissociative anesthetic was present in the toxicology results. Although there were not many dissociative anesthetics observed in the DIEs, the factors closely associated with this drug category were frequently observed in the DIEs. The following bullets highlight the factors which showed a difference:

- HGN was observed 92.3% of the time when a dissociative anesthetic was present in the toxicology results.
- There was an average of 5.38 clues observed when a dissociative anesthetic was present, but only 3.87 clues when a depressant was absent from the toxicology report.
- The mean value for the summary of the pulses for those DIEs where a dissociative anesthetic was present was 273.92 while those DIEs where a dissociative anesthetic was not present the mean value was 264.93.
- Those subjects whose toxicology results indicated the presence of a dissociative anesthetic performed poorly on the walk-and-turn (84.6%) and one-leg stand (69.2%) tests with a mean of 3.54 and 2.08 clues respectively.
- When a dissociative anesthetic was present on the toxicology report, Cannabis (69.2%), Depressants (15.4%), Stimulants (15.4%), and Narcotic Analgesics (15.4%) were also present in the data set.

A summary detailing the frequency of occurrence for each factor in relation to the presence of Dissociative Anesthetic drug category is provided in Table 24.

Table 24. Factor Frequency for Expected Observations: Dissociative Anesthetics

Sign or Symptom	Expected Observation	Dissociative Anesthetics % Present	% Not
		n=13	n=186
Coordination	Poor	46.2%	78.5%
Breath	Chemical	30.8%	10.2%
Condition of the face	Flush	46.2%	27.4%
Speech	Difficult	38.5%	62.9%
Marked Reddening of the Conjunctiva	Not Present	46.2%	50.5%
Condition of the eyes	Normal	84.6%	48.9%
Horizontal gaze nystagmus (HGN)	Present	92.3%	65.6%
Vertical gaze nystagmus (VGN)	Present	76.9%	26.3%
Lack of convergence (LOC)	Present	92.3%	93.5%
Romberg - Sway	Normal	53.8%	41.4%
Romberg - Eye tremors	Normal	61.3%	69.9%
Romberg - Body tremors	Normal	92.3%	88.7%
Romberg - Internal clock	Impaired	61.6%	53.5%
Walk-and-Turn	Poor Performance[1]	84.6%	89.2%
One-Leg-Stand	Poor Performance[1]	69.2%	83.9%
Condition of nasal cavity	Normal	69.2%	75.3%
Condition of oral cavity	Not Normal	76.9%	67.2%
Pupil size - Room light	Normal[2]	92.3%	81.7%
Pupil size - Near total darkness	Normal[2]	38.5%	34.9%
Pupil size - Direct light	Normal[2]	100.0%	78.0%
Pupil size	Normal[2]	23.1%	18.8%
Hippus	Not Present	100.0%	84.9%
Rebound dilation	Not Present	61.5%	73.1%
Reaction to light	Normal	76.9%	41.4%
Condition of muscle tone	Rigid	53.8%	4.8%
Injection sites	Not Present	100.0%	81.7%
Pulse (Sum)	Up[3]	38.5%	45.2%
Pulse (DRE)	Up[3]	46.2%	51.1%
Blood pressure	Up[4]	84.6%	31.2%
Body temperature	Up[5]	23.1%	3.2%
Depressants are Present		15.4%	55.9%
Stimulants are Present		15.4%	29.0%
Hallucinogens are Present		0.0%	0.0%
Dissociative Anesthetics are Present		100.0%	0.0%
Narcotic Analgesics are Present		15.4%	38.7%
Inhalants are Present		0.0%	1.6%
Cannabis is Present		69.2%	43.0%
No Drugs Present			6.5%

[1] Poor coordination which can translate to poor performance on the Romberg balance (sway), walk-and-turn, and one-leg stand tests.
[2] Normal range for pupil size is between 3.0 and 6.5 mm
[3] Normal range for pulse rate is between 60-90bpm
[4] Normal range for blood pressure is 120-140 mmHg (systolic) and 70-90 mmHg (diastolic)
[5] Normal range for body temperature is 98.6^{o} + or – 1^{o} F

Factors or Combinations of Factors Associated with Narcotic Analgesics

There were 74 DIEs where a narcotic analgesic was reported as present on the toxicology results. The factors that are considered consistent with the use of a narcotic analgesic were observed across those DIEs where the drug was present in the toxicology results. The following bullets highlight the factors which showed a difference:

- Slurred or slow speech was observed in 79.7% of the DIEs where a narcotic analgesic was present on the toxicology report as opposed to 50.4% of DIEs where a narcotic analgesic was not present.
- Constricted pupils were observed in 39.2% of the cases where a narcotic analgesic was present while only 8% of the DIEs without a narcotic analgesic present reporting the presence of constricted pupils.
- Those subjects whose toxicology results indicated the presence of a narcotic analgesic performed poorly on the walk-and-turn (94.6%) and one-leg stand (83.8%) tests with a mean of 4.50 and 2.64 clues respectively.
- Flaccid muscle tone was reported in 63.5% of the DIEs where a narcotic analgesic was present verses 37.1% of the cases where the drug was not present in the toxicology.
- When a narcotic analgesic was present on the toxicology report, Depressants (75.7%), Cannabis (32.4%), and Stimulants (25.7%) were also found in the data set.

A summary detailing the frequency of occurrence for each factor in relation to the presence of a narcotic analgesic drug category is provided in Table 25.

Table 25. Factor Frequency for Expected Observations: Narcotic Analgesics

Sign or Symptom	Expected Observation	Narcotic Analgesics % Present	% Not
		n=74	n=125
Coordination	Poor	83.8%	72.0%
Breath	Normal	75.7%	70.4%
Condition of the face	Normal	60.8%	64.8%
Speech	Slow	79.7%	50.4%
Marked Reddening of the Conjunctiva	Not Present	64.9%	41.6%
Condition of the eyes	Droopy/Normal	56.8%	48.0%
Horizontal gaze nystagmus (HGN)	Not Present	68.9%	66.3%
Vertical gaze nystagmus (VGN)	Not Present	70.3%	70.4%
Lack of convergence (LOC)	Not Present	95.9%	92.0%
Romberg - Sway	Poor Performance[1]	68.9%	51.2%
Romberg - Eye tremors	Not Present	81.1%	62.4%
Romberg - Body tremors	Not Present	91.9%	87.2%
Romberg - Internal clock	Slow	33.8%	22.6%
Walk-and-Turn	Poor Performance[1]	94.6%	85.6%
One-Leg-Stand	Poor Performance[1]	83.8%	82.4%
Condition of nasal cavity	Normal	81.1%	71.2%
Condition of oral cavity	Normal	40.5%	27.2%
Pupil size - Room light	Constricted[2]	28.4%	1.6%
Pupil size - Near total darkness	Constricted[2]	9.5%	0.0%
Pupil size - Direct light	Constricted[2]	37.8%	8.0%
Pupil size	Constricted[2]	39.2%	8.0%
Hippus	Present	17.6%	12.0%
Rebound dilation	Not Present	86.5%	64.0%
Reaction to light	Slow/Little to none	58.1%	55.2%
Condition of muscle tone	Flaccid	63.5%	37.1%
Injection sites	Possibly	21.6%	14.4%
Pulse (Sum)	Down[3]	8.1%	3.2%
Pulse (DRE)	Down[3]	8.1%	3.2%
Blood pressure	Down[4]	41.9%	33.6%
Body temperature	Down[5]	44.6%	30.4%
Depressants are Present		75.7%	40.0%
Stimulants are Present		25.7%	29.6%
Hallucinogens are Present		0.0%	0.0%
Dissociative Anesthetics are Present		2.7%	8.8%
Narcotic Analgesics are Present		100.0%	0.0%
Inhalants are Present		0.0%	2.4%
Cannabis is Present		32.4%	52.0%
No Drugs Present			9.6%

[1] Poor coordination which can translate to poor performance on the Romberg balance (sway), walk-and-turn, and one-leg stand tests.
[2] Normal range for pupil size is between 3.0 and 6.5 mm
[3] Normal range for pulse rate is between 60-90bpm
[4] Normal range for blood pressure is 120-140 mmHg (systolic) and 70-90 mmHg (diastolic)
[5] Normal range for body temperature is 98.6^{o} + or – 1^{o} F

Factors or Combinations of Factors Associated with Cannabis

There were 89 DIEs where Cannabis was reported as present on the toxicology results. The Cannabis category has several factors that are unique. The actual observations for these factors were consistent with the expected observations. The following bullets highlight the factors which showed a difference:

- Marked reddening of the conjunctiva was observed 73.0% of the time when Cannabis was present in the toxicology results as opposed to 30.9% of the time when the drug was not present.
- Pupils were generally found to be dilated, In 74.2% of the DIEs where Cannabis was present reported, DREs observed dilated pupils in contrast to 50.9% of the time when Cannabis was not present.
- When Cannabis was present, oral cavity debris was observed 84.3% of the time.
- Eyelid tremors were reported in 40.4% of the cases where Cannabis was present as opposed to 22.7% of the time when it was not present.
- Rebound dilation was observed in 42.7% of the subjects when Cannabis was present on the toxicology report, while it was only reported in 15.5% of the cases where Cannabis was not present.
- When Cannabis was present, Depressants (42.7%), Stimulants (31.5%), Narcotic Analgesics (27.0%), and Dissociative Anesthetics (10.1%) were also found in the DIEs.

A summary detailing the frequency of occurrence for each factor in relation to the presence of Cannabis drug category is provided in Table 26.

Table 26. Factor Frequency for Expected Observations: Cannabis

Sign or Symptom	Expected Observation	Cannabis % Present n=89	Cannabis % Not n=110
Coordination	Poor	66.3%	84.5%
Breath	Marijuana	12.4%	10.0%
Condition of the face	Normal	62.9%	63.6%
Speech	Slow	55.1%	66.4%
Marked Reddening of the Conjunctiva	Present	73.0%	30.9%
Condition of the eyes	Normal	50.6%	51.8%
Horizontal gaze nystagmus (HGN)	None	31.5%	27.3%
Vertical gaze nystagmus (VGN)	None	67.4%	72.7%
Lack of convergence (LOC)	Present	94.4%	92.7%
Romberg - Sway	Poor Performance[1]	59.5%	56.4%
Romberg - Eye tremors	Present	40.4%	22.7%
Romberg - Body tremors	Present	12.4%	10.0%
Romberg - Internal clock	Impaired	55.0%	53.2%
Walk-and-Turn	Poor Performance[1]	86.5%	90.9%
One-Leg-Stand	Poor Performance[1]	85.4%	80.9%
Condition of nasal cavity	Normal	61.8%	85.5%
Condition of oral cavity	Debris/Raised taste buds	84.3%	54.5%
Pupil size - Room light	Dilated/Possibly normal[2]	9.0%/84.3%	3.6%/80.9%
Pupil size - Near total darkness	Dilated/Possibly normal[2]	74.2%/12.4%	50.9%/43.6%
Pupil size - Direct light	Dilated/Possibly normal[2]	2.2%/83.1%	0.9%/76.4%
Pupil size	Dilated/Possibly normal[2]	74.2%/12.4%	50.9%/24.5%
Hippus	Not Present	89.9%	82.7%
Rebound dilation	Present	42.7%	15.5%
Reaction to light	Normal	44.9%	42.7%
Condition of muscle tone	Normal	60.7%	32.1%
Injection sites	Not Present	85.4%	80.9%
Pulse (Sum)	Up[3]	51.7%	39.1%
Pulse (DRE)	Up[3]	58.4%	44.5%
Blood pressure	Up[4]	36.0%	33.6%
Body temperature	Normal[5]	66.3%	54.5%
Depressants are Present		42.7%	61.8%
Stimulants are Present		31.5%	25.5%
Hallucinogens are Present		0.0%	0.0%
Dissociative Anesthetics are Present		10.1%	3.6%
Narcotic Analgesics are Present		27.0%	45.5%
Inhalants are Present		2.2%	0.9%
Cannabis is Present		100.0%	0.0%
No Drugs Present			10.9%

[1] Poor coordination which can translate to poor performance on the Romberg balance (sway), walk-and-turn, and one-leg stand tests.
[2] Normal range for pupil size is between 3.0 and 6.5 mm
[3] Normal range for pulse rate is between 60-90bpm
[4] Normal range for blood pressure is 120-140 mmHg (systolic) and 70-90 mmHg (diastolic)
[5] Normal range for body temperature is 98.6^{o} + or – 1^{o} F

One of the factors which was not observed by the DRE, but is considered when they make a prediction of a drug category is whether, during the DIE, the suspect admits to ingesting any drug. There is no expected observation for this factor and the weight the DRE places on the information varies greatly depending on the DRE and the situation. The following contingency tables (Tables 27 through 31) use Chi-square to test for independent of the suspect's admission from the DRE's prediction and the toxicology results according to category. Interesting, the results show that the prediction and the toxicology results are not independent from the suspect's admission. Later in this chapter, the selected DREs indicated that they do not place much weight on the suspect's admission of drug use.

Table 27. Depressants Category Chi-Square Table: Admissions, Predictions, and Results

			Suspect *Admits* to Drug Category	Suspect *Does Not Admit* to Drug Category	Totals
Drug Category *Present* on Toxicology	DRE *Predicts* Drug Category	O	69	21	90
		E	40	50	
		χ^2	21.03	16.82	
	DRE *Does Not Predict* Drug Category	O	5	11	16
		E	7	9	
		χ^2	0.57	0.44	
Drug Category *Not Present* on Toxicology	DRE *Predicts* Drug Category	O	7	11	18
		E	8	10	
		χ^2	0.13	0.10	
	DRE *Does Not Predict* Drug Category	O	8	67	75
		E	34	41	
		χ^2	19.88	16.49	
Totals			89	110	199

Note: Each cell contains two numbers representing frequency (observed and expected) as well as the calculated Chi-square value for the cell.

$\chi^2_{\text{Depressants}} = \Sigma\,[(\text{O-E})^2 / \text{E}] = 75.46$ $p<0.01$ df=1 $\chi^2_{\text{critical}} = 6.64$

Table 28. Stimulants Category Chi-Square Table: Admissions, Predictions, and Results

			Suspect *Admits* to Drug Category	Suspect *Does Not Admit* to Drug Category	Totals
Drug Category *Present* on Toxicology	DRE *Predicts* Drug Category	O	10	12	22
		E	2	20	
		χ^2	32.00	3.20	
	DRE *Does Not Predict* Drug Category	O	3	31	34
		E	2	32	
		χ^2	0.50	0.03	
Drug Category *Not Present* on Toxicology	DRE *Predicts* Drug Category	O	0	4	4
		E	0	4	
		χ^2	0.00	0.00	
	DRE *Does Not Predict* Drug Category	O	1	138	1
		E	10	129	
		χ^2	8.10	0.63	
Totals			14	185	199

Note: Each cell contains two numbers representing frequency (observed and expected) as well as the calculated Chi-square value for the cell.

$\chi^2_{\text{Stimulants}} = \Sigma\ [(\text{O-E})^2 / \text{E}] = 44.46$ $p<0.01$ df=1 $\chi^2_{\text{critical}} = 6.64$

Table 29. Dissociative Anesthetics Category Chi-Square Table: Admissions, Predictions, and Results

			Suspect *Admits* to Drug Category	Suspect *Does Not Admit* to Drug Category	Totals
Drug Category *Present* on Toxicology	DRE *Predicts* Drug Category	O	5	5	10
		E	0	10	
		χ^2	0.00	2.50	
	DRE *Does Not Predict* Drug Category	O	0	3	3
		E	0	3	
		χ^2	0.00	0.00	
Drug Category *Not Present* on Toxicology	DRE *Predicts* Drug Category	O	0	4	4
		E	0	4	
		χ^2	0.00	0.00	
	DRE *Does Not Predict* Drug Category	O	0	182	182
		E	5	177	
		χ^2	5.00	0.14	
Totals			5	194	199

Note: Each cell contains two numbers representing frequency (observed and expected) as well as the calculated Chi-square value for the cell.

$\chi^2_{\text{Dissociative Anesthetics}} = \Sigma\,[(O-E)^2 / E] = 7.64$ $p<0.01$ $df=1$ $\chi^2_{\text{critical}} = 6.64$

Table 30. Narcotic Analgesics Category Chi-Square Table: Admissions, Predictions, and Results

			Suspect *Admits* to Drug Category	Suspect *Does Not Admit* to Drug Category	Totals
Drug Category *Present* on Toxicology	DRE *Predicts* Drug Category	O E χ^2	35 14 31.50	14 35 12.60	49
	DRE *Does Not Predict* Drug Category	O E χ^2	10 7 1.29	15 18 0.50	25
Drug Category *Not Present* on Toxicology	DRE *Predicts* Drug Category	O E χ^2	5 3 1.33	6 8 0.50	11
	DRE *Does Not Predict* Drug Category	O E χ^2	8 33 18.94	106 81 7.72	114
	Totals		58	141	199

Note: Each cell contains two numbers representing frequency (observed and expected) as well as the calculated Chi-square value for the cell.

$\chi^2_{\text{Narcotic Analgesics}} = \Sigma\ [(O\text{-}E)^2 / E] = 74.38$ $p<0.01$ df=1 $\chi^2_{\text{critical}} = 6.64$

Table 31. Cannabis Category Chi-Square Table: Admissions, Predictions, and Results

			Suspect *Admits* to Drug Category	Suspect *Does Not Admit* to Drug Category	Totals
Drug Category *Present* on Toxicology	DRE *Predicts* Drug Category	O E χ^2	46 21 29.76	21 46 13.59	67
	DRE *Does Not Predict* Drug Category	O E χ^2	7 7 0.00	15 15 0.00	22
Drug Category *Not Present* on Toxicology	DRE *Predicts* Drug Category	O E χ^2	5 3 1.33	68 0.50	11
	DRE *Does Not Predict* Drug Category	O E χ^2	3 30 24.30	96 69 10.57	99
Totals			61	138	199

Note: Each cell contains two numbers representing frequency (observed and expected) as well as the calculated Chi-square value for the cell.

$\chi^2_{\text{Cannabis}} = \Sigma\ [(\text{O-E})^2 / \text{E}] = 74.38$ $\quad p<0.01 \quad$ df=1 $\quad \chi^2_{\text{critical}} = 6.64$

Summary of Quantitative Findings

The results of this type of analysis yielded practical illustrations of how often the observed conditions for the factors were consistent with the expected observations as taught in the DEC Program training. In some cases, there was a distinct difference between the percentage of DIEs where the DRE observed a factor when a drug category was present and the DIEs where it was not present. In contrast, other factors had similar frequencies between those DIEs where the drug category was present and those where there was no indication in the toxicology record of a drug in that category. This phenomenon may have been due to the presence of other drug category(s) with similar signs and symptoms to the drug category being analyzed.

The lack of convergence (LOC) factor was present in 93.4% of the subjects regardless of the drug category. Given the prevalence of the factor it does not seem to contribute specific information to the DRE which would subsequently inform their prediction of a drug category. It should be noted however that since the data were collected, the DEC Program modified the method by which the LOC test is conducted. This change in assessment methodology yielded a more discerning test for lack of convergence. In the future, the LOC should provide valuable information to the DRE for their decision-making process, but for the purpose of this study, the data did not seem to add value to the decision-making process due to its common occurrence.

Pupil size also provided conflicting information regardless of category. Based on the pupil size limits (all conditions - 3.0 to 6.5mm) used by the DRE at the time the DIEs were conducted, the pupil sizes tended to be dilated especially in the near total darkness condition. The frequencies for pupil size conditions in each of the three lighting conditions, according to drug category, are summarized in Table 32.

Table 32. Frequency of Occurrence of Pupil Size Observations in DEC Program Lighting Conditions Based on Drug Category

Exam Lighting Condition		Depressants	Stimulants	Dissociative Anesthetics	Narcotic Analgesics	Inhalants	Cannabis	All
		Drug Category Present in Toxicology Results						
	n	106	56	13	74	3	89	199
Room Light	Normal	77.4%	89.3%	92.3%	70.4%	100.0%	84.7%	82.4%
Room Light	Constricted	17.0%	7.1%	7.7%	28.4%	0.0%	6.7%	11.6%
Room Light	Dilated	5.7%	3.6%	0.0%	1.4%	0.0%	9.0%	6.0%
Near Total Darkness	Normal	36.8%	35.7%	38.5%	47.3%	33.3%	24.7%	35.2%
Near Total Darkness	Constricted	4.7%	1.8%	0.0%	9.5%	0.0%	1.1%	3.5%
Near Total Darkness	Dilated	58.5%	62.5%	61.5%	43.2%	66.7%	74.2%	61.3%
Direct Light	Normal	76.4%	82.1%	100.0%	62.2%	100.0%	83.1%	79.4%
Direct Light	Constricted	22.6%	17.9%	0.0%	37.8%	0.0%	14.6%	19.1%
Direct Light	Dilated	0.9%	0.0%	0.0%	0.0%	0.0%	2.2%	1.5%

The dilated pupil condition appears to be over represented in this data set. Since these DIEs have been conducted, the normal ranges for pupil size have been changes to reflect separate ranges for each lighting condition. Although employing the revised values for pupil size may have yielded different conclusions (normal, constricted or dilated), the original pupil size range was used during this analysis since those factor conditions were in place during the DRE's training and recertification as well as at the time the DIE was conducted.

The pulse rates were generally high regardless of drug category. If one the three pulses was up or down, then the factor was assigned to the drug category that supported that condition. In order to be considered normal, all three pulse measurements had to fall within the normal range of 60-90 bpm. In regards to the summary of pulses, the factor was considered normal if the sum was between the range of 180 and 270 bpm. Although the assignment of pulse measurement in this study was relatively restrictive, the DRE is not required to assign pulse readings within such strict standards and can use their experience and other observations to draw conclusions in regards to the pulse rate. One example of this subjectivity might be if the first pulse was high, but the remaining two readings were normal or low, the DRE may conclude the first pulse rate may be due to situational stress (confinement in a detention facility) and the second two are more representative of the condition of the suspect. This is a primary reason why the 12-step process requires three pulse readings in order to determine consistency of action that supports a prediction of a drug category(s).

Although there is a great deal of valuable information to be gleaned from frequency analysis of the factors according to drug category, more research must be completed to better understand the potential influence of factors or combinations of factors on the DRE's prediction of a drug category. One method of increasing the understanding of how these factors impact accurate decision-making is to use more of a constructivist approach by examining the decision-making instrument: the drug recognition expert. This exploration was conducted as a part of the third research question which examined the how selected DRE perceived those factors that influence their ability to accurately predict a drug category after conducting a DIE.

CHAPTER V

QUALITATIVE DATA ANALYSIS AND FINDINGS

In the first research question, the researcher examined the extent to which the drug recognition expert's (DRE) identified the appropriate drug category reported on the toxicology results. The second research question served as a follow-up inquiry to identify which factors or combinations of factors may have had an influence on the DRE's prediction of a drug category when compared to the toxicology results. The researcher applied quantitative methodology to investigate the first two research questions. Although the findings associated with these questions informed the purpose of the study, the researcher believed that representing the voice of the DRE was an important element of the study since it examined how the DEC Program training influenced DRE performance. Previous research related to the Drug Evaluation and Classification (DEC) Program had not capitalized on the use of qualitative data to inform the program. The researcher employed the final research question to delve into what selected DREs perceive as influencing their ability to predict a drug category accurately after conducting a drug influence evaluation (DIE) in an enforcement environment.

The qualitative results associated with the third and final research question is the focus of the fifth chapter. The qualitative results, presented in terms of themes evolved from the analysis of interviews of six selected DREs in Texas. The results provide a voice for the individual DRE and inform the findings of the first two research questions.

Discussion of Qualitative Results: Research Question Three

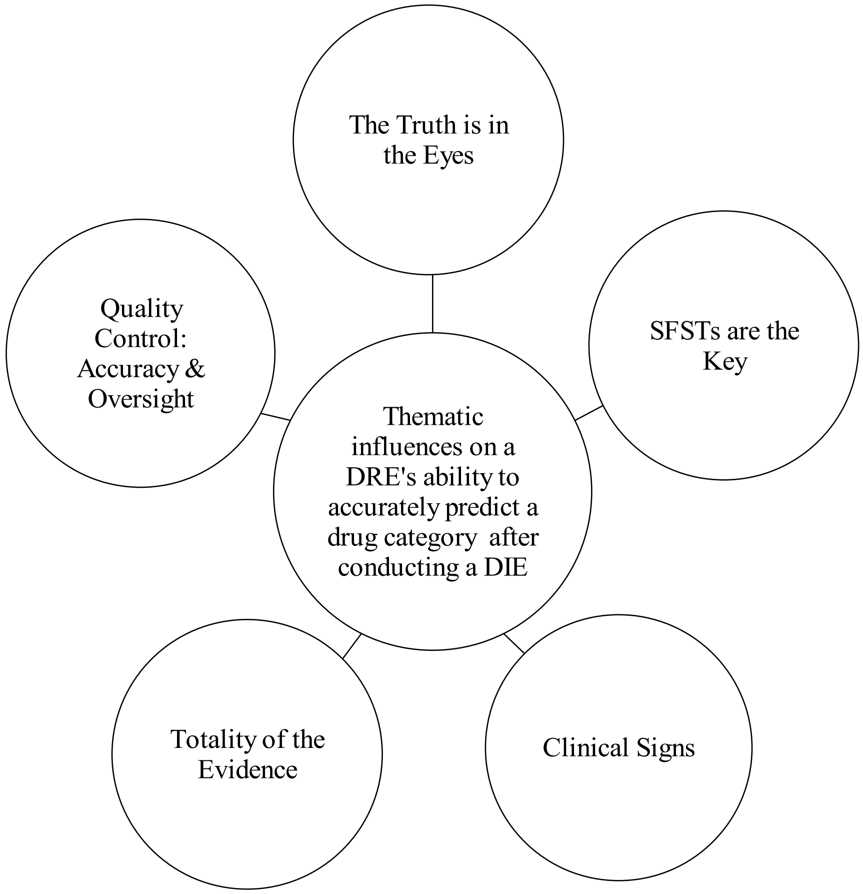
The researcher interviewed six DREs to determine, based on their experience as a DRE, what they perceived as influencing their ability to accurately predict a drug category after conducting a DIE in the enforcement environment. Interviews served as the data-gathering vehicle for this inquiry. Although the interview focused on uncovering factors or combinations of factors the DRE officer perceived as contributing to an accurate prediction, the interview was not restricted to a set of specific questions as to allow a free flow of commentary on the part of the DRE.

The researcher completed the quantitative analysis before the interview process commenced. Based on the analysis of the quantitative data and the review of literature, several issues or questions surfaced which resulted in the development of preliminary themes that helped to inform the qualitative data collection and analysis. One of the issues highlighted was the number of variables that individuals can reasonably consider in a decision-making process. In contrast, the concept of making predictions based on the totality of the evidence also emerged as an important component in the DEC Program research and training materials.

Emergence of Themes from Qualitative Results

The result of this element of the study was the emergence of several themes that illustrate the perceptions of the six DREs who participated in the interview process. A theme is an idea that recurs in or pervades a form of communication, such as a dialogue, work of literature or musical composition (Landau, 1997). In the case of this study, a theme is a topic or issue that was common across the interviews, literature, or, even, the quantitative analysis applied to the qualitative piece of this research. Ruona (1999) refined the concept of a theme as a collection of closely correlated sub-themes that are defined according to the essence of the communication on the part of the participant. Although the sub-themes are highly related, they may also be repeated in part within a separate theme creating some interesting crossover. The scope of each theme was defined based on the information gleaned from the interviews and informed by the literature review. The reader will understand the essence of the DRE's beliefs as to what drives their decision-making during the DEC Program's prescribed 12-step process based on the data from the interviews. The five themes that emerged from the interviews provided an analysis framework for addressing the third research question are illustrated in Figure 16 followed by a brief overview of each theme.

Figure 16. Illustration of Themes Representing Perceived Factors That Influence the DRE's Ability to Accurately Predict a Drug Category



A Brief Overview of the Themes from the Qualitative Data Analysis

- The Truth is in the Eyes. *The Truth is the Eyes* theme suggests that a DRE can observe critical information as to whether an individual is impaired based on the condition and behavior of the eyes. This theme not only stood out in and of itself, but also in part as a subtheme in three of the other themes. It has been said that the eyes are the window or mirror to the soul (Titelman, 1996). In the case of a drug influence evaluation, the DREs reported that the eyes are the window to the truth about the substances that impair many of the drivers they encounter in the enforcement environment.

- SFSTs are the Key. The *standardized field sobriety tests* (SFSTs) are basic psychophysical tests used to identify and assess the impaired driver. Originally, the SFSTs were developed for law enforcement to administer at roadside when assessing drivers suspected of being under the influence of alcohol. Eventually, the DEC Program adopted the SFSTs as a tool for DREs to assess suspected drug impaired drivers in a more control environment such as a detention facility.
- Clinical Signs. The theme of *Clinical Signs* includes factors such as blood pressure, body temperature, pulse, pupil size, and overall physical condition. Unlike the SFSTs, these factors are DEC Program specific and rely on observations collected in a controlled environment such as a detention facility. The DRE also needs to carefully consider each of these results based on consistency (across three pulses and pupils sizes in three lighting conditions) as well as the individual's physical condition. According to the DREs, the combination of factors offers great insight into which drug category may be influencing the impairment of the suspect. The DREs that were interviewed noted that the context of the observations related to the clinical signs should be considered when the DRE predicts a drug category.
- Totality of the Evidence. One of the overarching constructs of NHTSA impaired driving enforcement training programs is the concept of decision-making based

on the totality of the evidence. This approach encourages officers who work in the detection and assessment of suspected impaired drivers to take into account as many factors as possible in order to support their arrest decision. This belief not only emerged as a theme in the interviews, but also figured prominently in the training curriculum as well as other communications in the enforcement and prosecution communities.

- Quality Control: Accuracy and Oversight. Accuracy is an important concept in the DEC program at the individual DRE level since the evidence gathered as part of the DIE is the basis for a criminal case. Additionally, accuracy is critical in a broader sense in terms of the value of the DEC Program's 12-step process as an efficient and reliable means of assessing the suspected drug impaired driver. The process has a built-in feedback loop through the toxicology results, but this information tends to only inform the individual DRE in terms of performance when the aggregate data could serve to drive improvement in the other performance domains.

Structure of This Section of Results

This section focuses on the descriptive accounts and the interpretations of perceptions that selected DREs have in regards to the factors or combinations of factors that may influence the accurate prediction of a drug category during a DIE in the enforcement environment. Previously identified themes as well as those emerging from the qualitative investigation related to this study are detailed in the following sections.

The researcher wanted to place heavy emphasis on the actual words of those that were interviewed through excerpted quotes from their interview transcripts. The quotes have been separated from the narrative and are bulleted using a double-quote mark (”) as well as presented in italics (Ruona, 1999). For example:

” *This is the format for any quote used to represent the perception and voice of an individual interviewed as part of this study. The language was excerpted directly from the transcript of a participant’s interview and present in its original context. The quote will be indented, bulleted with a double-quote mark, and italicized.*

The themes are outlined in the following subsections of Chapter V. Following the description of each theme, a mind map provides a visual aid to demonstrate the relationship and integration of sub-themes as well as highlight the essence of the interview data as it relates to that theme. A mind map is a diagram that helps to covey words or ideas in terms of their linkages to each other. Mind maps are similar to a schematic or cognitive map with elements of that map being groups onto branches with the goal being the generation of a relevant framework that helps to support a concept. The reader should interpret the mind maps in a clockwise manner. The mind maps introduce and frame the discussion of each theme.

Discussion of the Theme The Truth Is in the Eyes

There are several eye observations that contribute to the DRE's decision-making process during a drug influence evaluation. Each factor associated with the eyes provides information that is useful in predicting or excluding individual drug categories during a drug influence evaluation. This theme, along with the second and third themes, Clinical Signs and Totality of the Evidence respectively, were the most significant themes that emerged in the study. Each of the DREs articulated the significance of factors that were included in these themes. The mind map in Figure 17 provides an overview of this first theme together with associated subthemes and factors linked with the eyes and as highlighted by the selected DRE interview participants. The mind map is intended to illustrate the theme in terms of subthemes and DRE feedback related to each subtheme. This approach allows the reader to use the mind map as a relational outline for the presentation of the qualitative data.

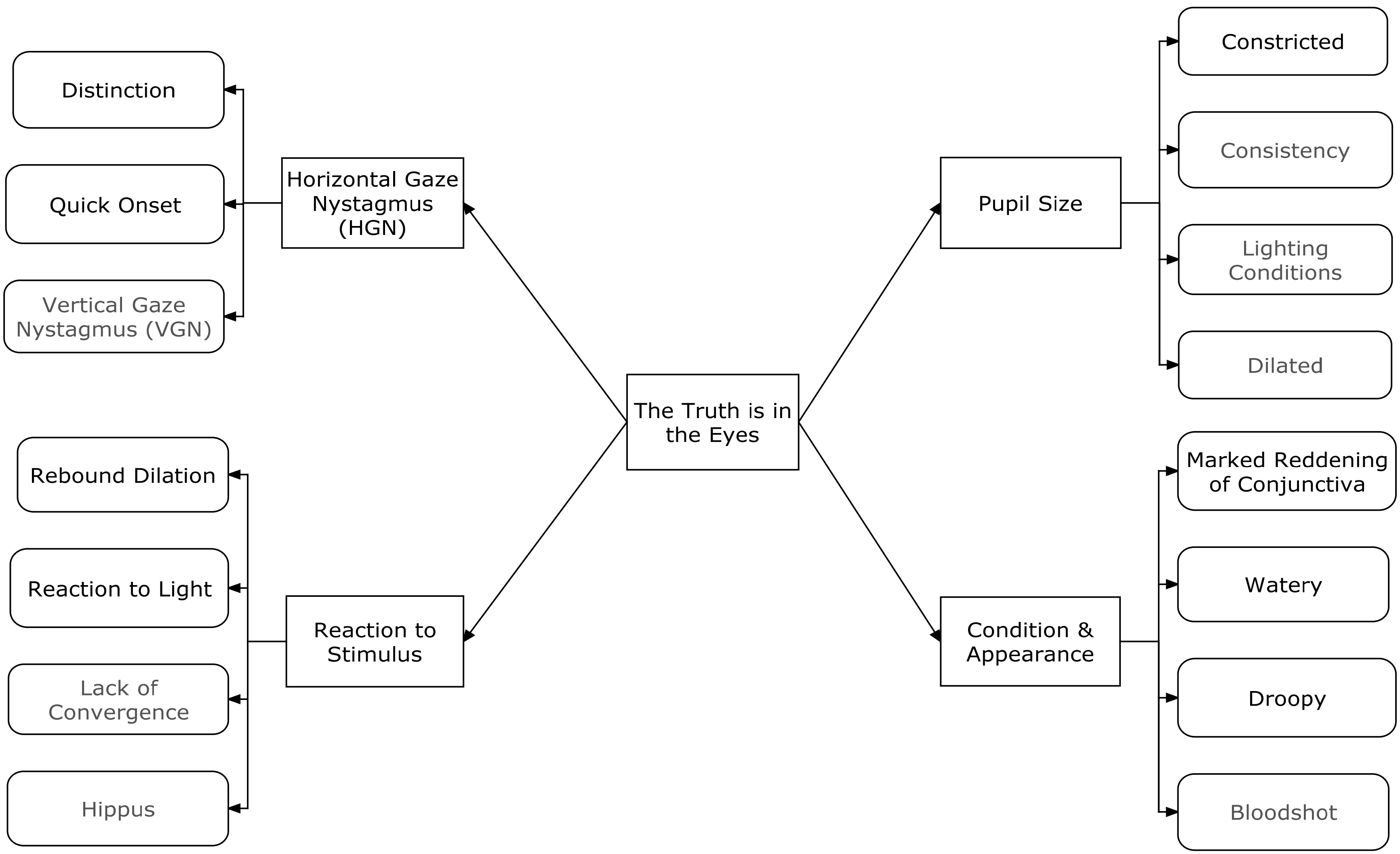
Horizontal and Vertical Gaze Nystagmus

Horizontal and vertical gaze nystagmus is the test used to identify the presence or absence of gaze nystagmus according to prescribed and validated procedures. Officers rely heavily on these tests to identify those categories where HGN/VGN is typically observable: Depressants, Dissociative Anesthetics, and Inhalants.

- *HGN equals depressant including alcohol and maybe PCP (Dissociative Anesthetic).*

- *HGN is expected in three of the categories, but we never catch anyone on an inhalant and PCP pretty evident without HGN, so we figure that a depressant is likely.*

. **Figure 17. Mind Map Illustrating the Theme The Truth is in the Eyes and Related Subthemes**



The DREs also discussed HGN in terms of onset as a key indicator when the suspect is under the influence of a Dissociative Anesthetic such as PCP. This occurrence was unique to this drug category in terms of HGN.

- *If it was just a hard core PCP (Dissociative Anesthetic) case, those are the guys that, obviously, the HGN was very pronounced, had vertical wobbles all the time.*

- *Even at low doses on PCP, they have a very, very strong onset of HGN which you are not going to see with a depressant unless they are so drunk they are about to pass out. And you won't see that with PCP.*

Pupil Size

Pupil size may sometimes be difficult for the DRE to gauge in terms of millimeters based on the different lighting conditions, but all of the interviewed DREs regarded pupil size as a predominant factor in their decision making.

- *The two that I rely on for almost all categories the most are pupil size and pulse rate.*

Pupil size is one of the factors that drove the prediction of specific drug categories according to the interview data. The presence of constricted pupils emerged as a significant factor in the prediction of the Narcotic Analgesic category while dilated pupils drove the selection of Cannabis and the Stimulant categories.

- *That is one of the big things we look at. As soon as we walk up, and if the person's eyes are constricted, our mind set is already going that direction (a narcotic analgesic).*

- *It is hard to confuse those with anything else, especially narcotic analgesics because it is the only drug category that constricts pupils.*

- *With the THC content, especially in Texas you are always going to have dilated pupils.*

> ” *Narcotic Analgesics, the really big one on those is we put a lot of faith into the pupil size.*

The use of pupil size as a key factor was prevalent in the data. The DREs also reported that, although there is no specific direction or criteria in the training materials, they try to balance their observations based on the consistency of the pupil sizes in the different lighting conditions.

Reaction to the Stimulus

During the eye tests, the DRE asks the subject to focus on a stimulus while the DRE observes the reaction of the eyes to the movement of the stimulus as well as the reaction to the introduction of a light source. The results of these tests provide valuable information to the DRE in terms of the drug category which may be influencing the behavior of the subject. The following section details the feedback that the selected DREs provided through their interviews concerning the *Reaction to the Stimulus*.

Rebound Dilation, Reaction to Light, and Hippus. Rebound dilation is defined as a period of constriction followed by dilation with a change equal to or greater than 2 mm is defined as rebound dilation (NHTSA, 2007). The factor termed reaction to light considers how an individual’s pupils react to the introduction of light may appear to be slow in the presence of Depressants, Stimulants, or Inhalant, but the DRE expects to find little to none visible when the individual is impaired by a Narcotic Analgesic. Hippus referred to the phenomenon referred to as hippus is the rhythmic pulsating of the pupils of the eyes as they dilate and constrict within fixed limits.

- *Hippus and rebound dilation are a little hard to learn, but after some practice in training, they are easier to observe properly. They are unique to specific categories, so when they are there they are good indicators of that drug.*

- *We see slow reaction to light all the time, because everyone seems like they are on a depressant or narcotic around here.*

Lack of Convergence. One of the factors identified during the eye examinations is the ability of the individual to converge (cross) their eyes while focusing on a stimulus that is moving towards the bridge of their nose. The lack of convergence is a natural phenomenon that exists in some individuals, but it is also indicative of some categories of drug use. The DEC Program teaches that lack of convergence is frequently present in individuals under the influence of a Depressant, Dissociative Anesthetic, or Cannabis.

- *Lack of convergence is easy to see, if it is there. Individuals who are high on marijuana (Cannabis) tend to have eyes that just can't stay crossed. They get so far then try to jump back to their original position.*

Condition and Appearance

Marked Reddening of the Conjunctiva. The reddening of the inside of the lower eyelid is another factor which is identified during the eye examinations.

- *When we examine the eyes and pull down the lower eyelid and see that bright red conjunctiva, it is a good bet that they have been smoking some marijuana.*
- *Reddening of the conjunctiva is another strong indicator of cannabis.*

Condition of the Eye. The DREs are taught to examine the general appearance of the eye and note anything they believe is not normal.

> ” *We tend to write down a lot about the eyes. Droopy, bloodshot, watery. The eyes just tell you a lot about whether someone is under the influence of something.*

The DREs report that the eyes cannot hide signs of impairment. The DREs consistently rely on this information to make informed decisions in the field. Based upon the feedback from DREs interviewed and the information gleaned from the literature review, eye observations emerged as a theme.

Discussion of the Theme SFSTs Are the Key

Officers originally trained to use a three-test battery: horizontal and vertical gaze nystagmus (HGN/VGN), walk-and-turn (WAT), and the one-leg stand (OLS) tests. During the interview process, it was determined that in the context of a DIE, some DREs have come to regard the SFSTs in terms of an expanded battery that includes the Romberg balance and the finger-to-nose tests. Consequently, when an interview participant identified the SFSTs as one of the combinations of factors that most influenced their predictions during a DIE, they mean HGN, WAT, and the OLS as well as the Romberg balance and finger-to-nose tests.

> ” *I look and see how they perform on the SFSTs, not the normal SFST, obviously HGN, the walk and turn and one-legged stand, but I also look at the Romberg and the finger-to-nose.”*

> ” *Between the HGN and the actual field sobriety tests, the divided attention tests, I honestly consider that to be your most accurate stuff.*

The mind map referenced in Figure 18 groups WAT, OLS, the Romberg balance and the finger-to-nose tests into one subtheme related to divided tests and separated HGN/VGN into an eye test subtheme.

Divided Attention Tests

The findings suggest that the DRE not only takes the time to assess the suspect in terms of the clues associated with the WAT and OLS tests, but also takes care to observe other signs that possibly linked to impairment by a specific drug category.

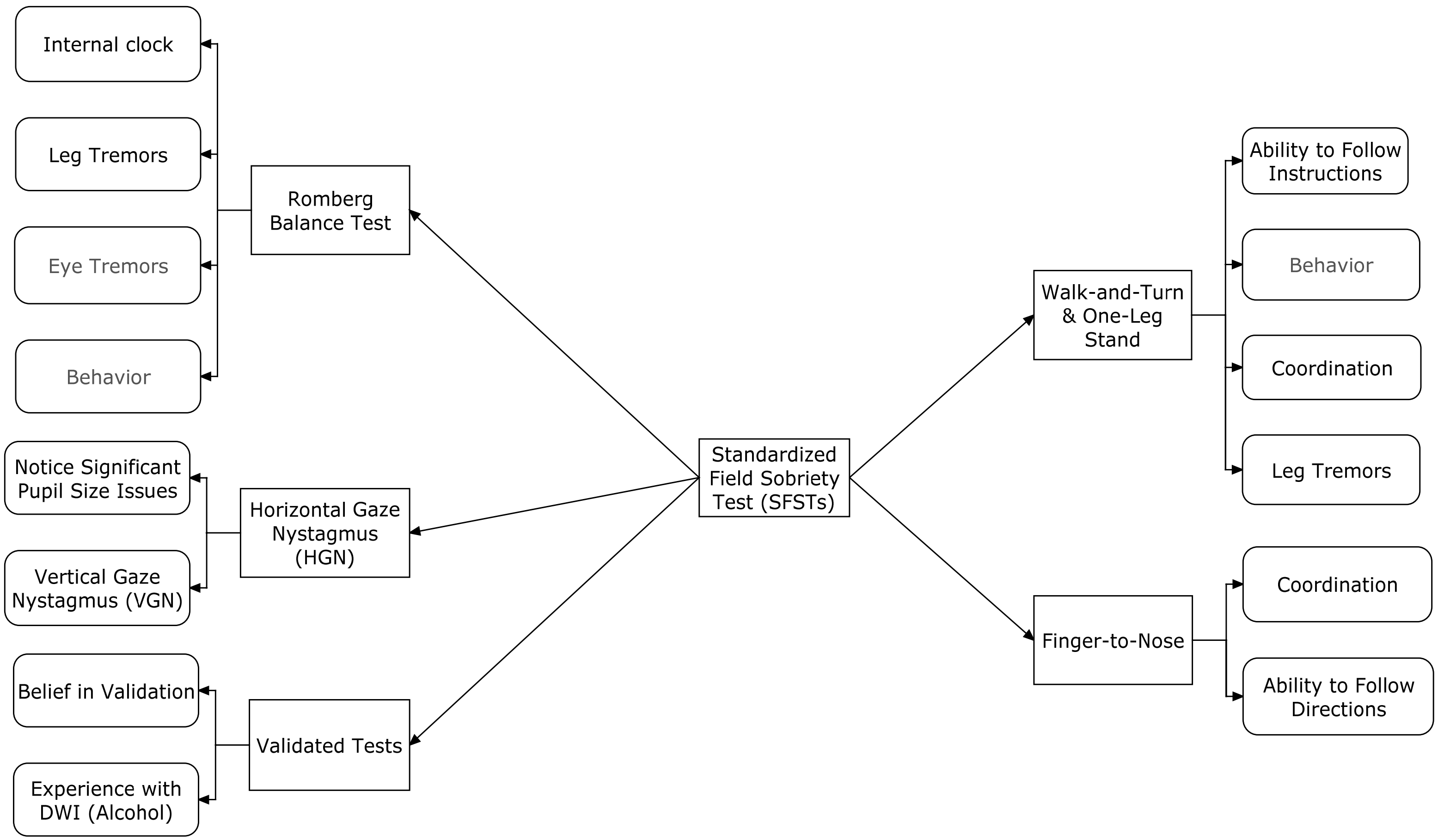
- *There are not a specific number of clues associated with a level of drug in a person's system like there is with alcohol, but the occurrence of clues is meaningful. A lot of times, the person does so badly on the tests that types of clues are just secondary.*

- *With depressants and narcotics that person has real problems with the SFSTs; not only do they do poorly on the task; they have a difficulty remembering what they are supposed to be doing.*

The DRE gathered additional information through the Romberg balance test.

- *I like the Romberg balance test. You have the chance to see balance issues, tremors and how they estimate the passage of time. Sometimes I think that the suspect fell asleep since they have their eyes closed and forget to tell you they think 30 seconds have passed. This test provides me with several observations that I use to predict a category.*

Figure 18. Mind Map Illustrating the Theme Standardized Field Sobriety Tests (SFSTs) and Related Subthemes



Eye Tests

The eye examinations used as part of the SFST test battery include horizontal and vertical gaze nystagmus. The DREs who mention the SFSTs as factors or combinations of factors that assists them in predicting a drug category focused on the evidence gathered throughout the test battery and did not give any additional weight to the eye tests specifically.

> ” *The HGN and especially the VGN for some categories, provides information that compliments the walk-and-turn, Romberg, and one-leg stand tests. When I think the person is on something other than alcohol, I really pay attention to the onset.*

The SFSTs are tests in which DREs are very comfortable because they have used them long before they completed the DEC Program training. DREs rely on the SFSTs because they consistently the officers still assess more suspects under the influence of alcohol than they do drugs, especially those DREs who are assigned to DWI task forces or traffic units.

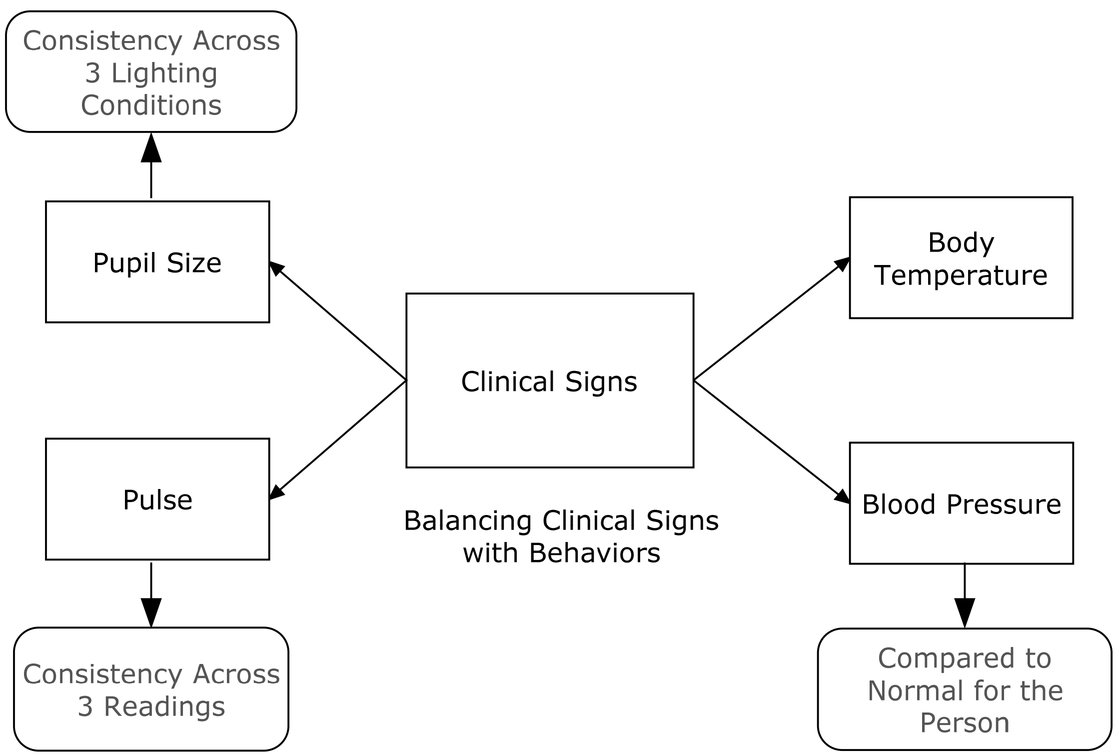
Discussion of the Theme Clinical Signs

The factors included in the clinical signs theme were blood pressure, body temperature, pulse, and pupil size. Other factors that might have been included in this theme based on the literature review and quantitative analysis, but those factors were not identified by the DREs as being significant contributors to their decision-making and have not been referenced in this sub-section.

Translating the Clinical Signs

Although there were four different subthemes identified in relation to *Clinical Signs* as a theme, it was difficult to separate the DRE's words since they tended to talk about clinical signs in pairs or in their entirety. There were four subthemes related to clinical signs that emerged during each of the six interviews with the DREs: pupil size, body temperature, blood pressure, and pulse. The *Clinical Signs* theme is illustrated in the mind map in Figure 19.

Figure 19. Mind Map Illustrating the Theme Clinical Signs and Related Subthemes



The following quotes provide a cross-section of the discussion related to clinical signs and their contribution to the identification of a drug category(s).

- *Narcotics - constricted pupils, again, is one of the strongest indicators and the slow, weak pulse with narcotics is strong indicator of narcotics use. It is hard to confuse those with anything else, especially narcotic analgesics because it is the only drug category that constricts pupils.*

- *On depressants, it would probably be the most important one that stands out would be pulse.*

- *The two that I rely on for almost all categories the most are pupil size and pulse rate.*

- *There are so many other factors that are included, like blood pressure and temperature that are important, but my main focus when I am doing the DRE eval is pupil size and pulse rate.*

- *It depends, because a lot of times, people, say for instance they come in and their initial pulse rate is high, it could be because they are nervous, they are under arrest, they have stress, a lot of factors. But during about the 45 minutes to 1 hour that they spend with us while we are doing the evaluation, typically you see their pulse rate start going down. But depending on the drug category, if it starts high and remains high completely through, that is an indicator.*

- *Stimulants, again, the strongest indicator of stimulants are pupil size and pulse rate. Those two by themselves are a very strong indicator of what a person is on. Typically, with stimulants, the pupils are going to be very dilated and the pulse will be very high.*

Balancing the Clinical Signs

One of the significant things highlighted during the discussions related to clinical signs was the need to balance or weigh the factors considered.

- *If it starts high (pulse) and then comes down and remains down over the entire eval, then that is significant. You can’t, just from taking one pulse, especially at the beginning, be able to come up with a definitive answer as to what the person is under the influence of.*

> ” *Don't get me wrong, if you have a 180 beat/minute pulse, obviously I'm going to take that into consideration, but, you know, if it's standard, if it's 60-90, and you get two out of three elevated ones, right after you might have done your SFSTs because you've been active, again, it goes down and I look at it, and I take it into consideration, but your eyes dancing all around, to me, tells me a lot more.*

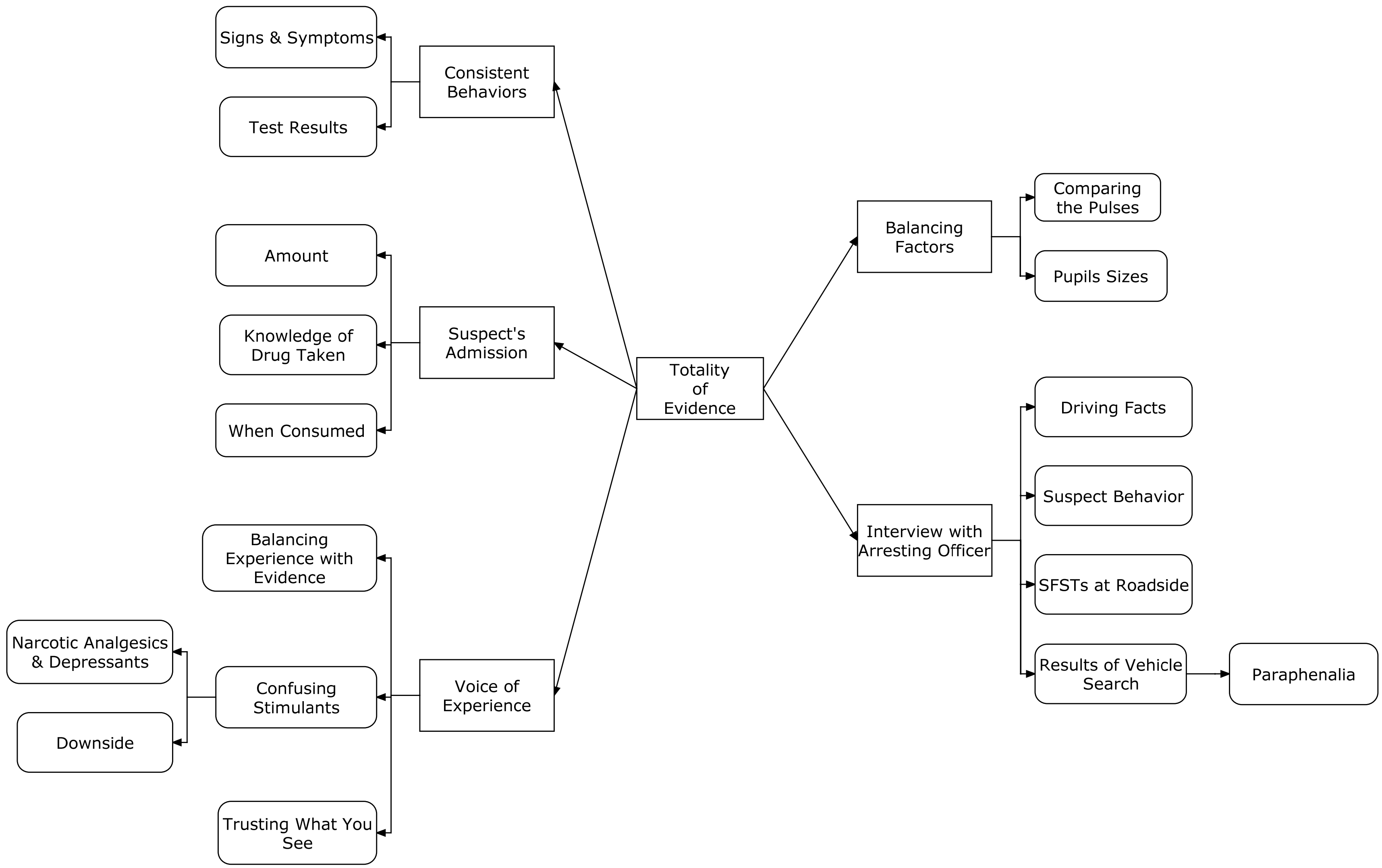
This was not the same caution discussed in terms of the totality of evidence, but rather an awareness of the fact that clinical signs can be influenced by physical activity, like the SFSTs, or by mental state. This was a prevalent sub-theme related to the clinical signs especially.

Discussion of the Theme Totality of the Evidence

The concept of the totality of the evidence was easily illustrated in relation to roadside DWI enforcement since the detection process is divided into three different phases, vehicle in motion, personal contact, and pre-arrest screening. The data gathered throughout the phases support an arrest decision based on the totality of the evidence collected in each separate phase. This process also supports the practical fairness of the tests that is important to communicate during the adjudication process. In the DEC Program's 12-step process, the DRE does not have interim decision points, but are tasked with collecting a standardized set of factors in order to draw conclusions regarding the presence of impairment and the drug category(s) responsible for observed impairment.

Although the concept of considering the totality of the evidence is a programmatic goal, the data, interviews, and DIE, as well as the literature indicates something less than that. It appears that the DRE considers a subset of factors as the practical reality. At first, this revelation seemed to be a negative reflection on the promoted standardization of the DEC Program, but the DREs do consider factors or combinations of factors, which that are supported based upon scientifically validated studies (Bigelow, Bickel, Roache, Liebson, & Nowowieski, 1985; Heishman, Singleton, & Crouch, 1996 & 1998;). Additionally, the DREs admission of utilizing a subset of factors or combinations of factors is consistent with the programmatic research that highlights an individual's inability to handle an excessive number of variables in decision-making (Heishman, Singleton, & Crouch, 1996 & 1998; Shinar & Schechtman, 2005; Smith, Hayes, Yolton, Rutledge, & Citek, 2002). The *Totality of the Evidence* theme and its subthemes are detailed in Figure 20.

Figure 20. Mind Map Illustrating the Theme Totality of Evidence and Related Subthemes



The DREs defended the belief that they must balance multiple factors especially when they suspect the individual is under the influence of more than one drug, or a drug or drugs in combination with alcohol, in order to determine if an observation is consistent with a particular drug category.

Consistent Behaviors

- *On the depressants, I look for drunk-like behavior. Typically, the person looks like they are intoxicated on alcohol, and until you start doing the DRE test you don't realize, without the alcohol smell, that they are actually under the influence of depressants.*

- *When you first look at PCP, especially with the HGN, you may want to form the opinion that they are under the influence of a depressant. But when you start looking at the body movements, the way they process information, the general clues lead you to believe it is PCP more than anything else. Because even at low doses on PCP, they have a very, very strong onset of HGN which you are not going to see with a depressant unless they are so drunk they are about to pass out. And you won't see that with PCP. They will get an immediate angle of onset and they will get robot-like, rigid, but they will be able to stand up and won't fall down.*

- *With PCP (Dissociative Anesthetics) and depending on what mental state they were in, it can cause you problems, or as far as their actions, you know if they turn on you, if they have that adrenaline dump, like you have always heard about.*

- *With a Narcotic Analgesic, as far as their behavior, lethargic, very sluggish, very slow, almost to the point that they just almost fall asleep on their feet.*

- *Someone under the influence of alcohol is going to have slowed reactions and some of the appearances of a person that is on narcotic analgesics, but narcotic analgesics will have no HGN, and the presence of pupil size is probably going to be normal unless they are taking one of the exceptions, whereas narcotic analgesics you're going to have on the nod, very constricted pupils, the dry mouth, and those type of indicators.*

- *May be something as minor as people that are on the nod are awake and they hear what is going on around them, but they are just slow to respond. Whereas a person who is on the downside of a narcotic analgesic will be on the nod but they won't have that awareness.*

Balancing Factors

- *If it starts high and then comes down and remains down during the entire course, then that is significant also. You can't, just from taking one pulse, especially in beginning, be able to come up with a definitive answer as to what the person is under the influence of."*

- *There again, when you first look at someone, suppose they are coming down off of crack, which is a very fast acting drug, you may see a slight constriction of the pupil, which on the downside is significant, and you may have a depressed pulse rate and temperature, and blood pressure, which are all indicators of someone who is on the downside of a stimulant. It is not unusual at all. And without taking all those factors into consideration, you may want to conclude that someone is under the influence of a depressant, when in reality, they are just coming down from a stimulant."*

Evidence from the Arrest

Part of the DEC Program's 12-step process is interviewing the arresting officer. During this exchange, the DRE can not only glean information related to driving facts and behaviors, but also use that opportunity to identify physical evidence that might be linked to recent drug use.

- *I would rank the arresting officer interview, I mean, you will get a lot of stuff from out there (arrest location), if you know the right questions to ask the officer you can get a lot of good information.*

- *There is almost always some physical evidence found at the time of the arrest, either a paint can, or a syringe, or a rubber tourniquets and spoon, or something in the vehicle or on the person that is going to be* *physical evidence, say it could be a crack pipe or a bong pipe. I mean, if an individual is arrested, he's got a crack pipe in his pocket, he's got five or 6 cigarette lighters that have been used up, it didn't take a rocket scientist to figure out he is probably smoking crack."*

Interview with the Suspect

The DRE is also expected to interview the suspect to collect information about whether they are under a doctor's care, recently injured, eaten or drank anything recently, and account for any physical restrictions that might prevent them from performing any of the test. One of the most important pieces of data the DRE is after is any drugs that might have been consumed. This information is included in the evaluation and the interviewed DREs addressed their use of that information during the interviews.

- ” *As unbelievable as it may sound, my experience in narcotics has shown me that a lot of times people don't know what they are taking.*
- ” *I listen to them and I do take that into consideration, and I can put a high percentage of reliability on it; However, I put an asterisk by that, because I do take it with a grain of salt. I mean, because they are twisted, they are messed up on a drug, so regardless of how much you've taken them into their confidence, they don't always tell you the truth.*
- ” *I would consider insignificant something like that. But now, if you've got all these other factors, especially like HGN, VGN, SFST, their behaviors, you know, maybe the arresting officer, and then that was thrown in there, well, then that would be taken into consideration for what it's worth."*
- ” *(Subject Admission) On me, personally, none. On the students that I teach, a lot. One of the things that I have continually preached over and over and over to the students is to completely disregard what they tell you about what they are on. Because so many times the students will be unsure about what they should call as far as categories go that the person is on that they want to fall back as a crutch on what they have been told. And most of the time the indicators that they are being shown and what the person has told them they have taken have no correlation. They are*

> *either completely opposites or near opposites. So I try to tell them, and I teach and ingrain in the students I teach, disregard what they tell you. Go with what you see, go with your clinical signs.*

Voice of Experience

The interviewed DREs varied in experience and half of those included were also certified as instructors which provided a different context for some of the statements made during the interview. All of the respondents cited experience, not only as a DRE, but also as a police officer who comes in contact with non-drivers who are drug impaired, as a pivotal factor in their ability to interpret factors or combinations of factors in their decision-making process.

- *Where they hand rolled marijuana cigarettes, are not very tight, so when heat hits one of the air pockets on those marijuana cigarettes, they kind of have a little pop to them; it will pop the THC onto the front of their clothing and everything. In a dark room, in a black light, we get one of those little battery operated handheld black lights and it kind of, it fluoresces. You can just see the little specks.*

- *May be something as minor as people that are on the nod are awake and they hear what is going on around them, they are just slow to respond. Whereas a person who is on the downside of a narcotic analgesic will be on the nod but they won't have that awareness. You can teach that in a classroom, but until they actually see it and experience it a few times, it's not ingrained into their experience.*

- *Like somebody on PCP, if you have been around somebody on PCP two or three times, from then on after that you can pretty much spot them from 10 feet away. The subtle indicators that you have then experienced, that you have been shown, and that you know immediately steer you in that direction."*

- *That more than anything else is experience, because as much training as I have done over the years, when the students first get into the field* *situation and they look at someone that is under the influence of a stimulant, but they are on the downside, they almost always want to call either narcotic analgesics or a depressant. But, when you look at all the factors combined, it is very clear that they are on the downside of a stimulant. And it is easy to pick out.*

- *You have to be careful. There are the subtle differences between someone who is on the downside of a stimulant and on a narcotic analgesic.*

- *As each drug category is different, each drug category will have a different main sticking point, I guess, to look for.*

Of all the themes, the *Totality of the Evidence* seems to be the most cross cutting. The term, *totality of the evidence*, was pervasive in each of the selected DRE interviews. When a DRE articulated the importance of the SFSTs or clinical signs, he or she always buttressed their assertions with comments regarding context. The selected DREs understood that although they may rely on a certain subset of factors as a means to make effective predictions of a drug category(s), those factors have to be considered in terms of the whole evaluation as well as their previous experiences with conducting DIEs. This is not surprising, since the concept of considering the totality of the evidence conveyed in all NHTSA impaired driving enforcement training and serves as a catalyst for developing probable cause to arrest when conducting roadside assessments (NHTSA, 2007). It is also an important concept for the prosecution since they try to *paint a picture* for the judge and/or jury of what officer experienced in the field or during a DIE. The goal of the prosecution is present the evidence so that the judge and/or jury can draw conclusions of the suspect's performance and determine impairment existed in order to convict.

Discussion of the Theme Quality Control: Accuracy and Oversight

Quality control emerged as a theme, but only indirectly. Quality control in relation this study deals with the DRE's individual accuracy in regards to their prediction of a drug category. Additionally, quality control extends to the methods used to oversee the performance at the individual, agency, state and program levels. The individual DRE understands the concept of controlling decision-making quality of the on the part of the individual DRE is understood, but the feedback loop for performance information are antiquated. The feedback directly related to the issues relevant to transfer climate and motivation referenced in the literature review chapter of this study was included in the *Quality Control* theme. The quality control theme separates into four performance domains: individual, process, organization, and community. The *Quality Control* theme and its related subthemes is illustrated in Figure 21.

Figure 21. Mind Map Illustrating the Theme Quality Control and Related Subthemes

Individual Performance

The DRE monitored their individual performance, through documentation on the rolling log and the entry of information into an electronic database. The agencies do not monitor whether the rolling logs are current and the DREs admit that they are diligent about recording the evaluations, but neglect the toxicology results.

- Sometimes I do not have enough enforcement evaluations when I get ready to go for recertification, so I have to complete simulated ones when I get there.
- There are a lot of refusals in this area. I have heard that other places use warrants to get the testing done, but you still have to wait forever for the results.
- *Yeah, I mean, I'll be happy with that. I mean, now if I get zero out of whatever, and that's a pattern, that's not an agency reflection, that's me. I mean, obviously I'm messing something up; I'm not doing something correctly.*
- *I want to know, just to see how am doing as a DRE. But as far as the agency, I think they're looking way down the road, as far as prosecution and don't worry about the DRE's performance unless it goes to court.*

Process Quality

The concept of process as it relates to the DEC Program is defined by initial training, recertification, deploying the 12-step process in the field, and feedback through toxicology results as well as the ability to inform training through research and field performance. One of the issues that was highlighted was the difficulty in receiving feedback due to refusals on the part of the suspect and long delay times for receiving the toxicology results.

- We are suppose to keep our rolling logs updated, but sometimes we don't find out the results until they are ready to take it to court. And sometimes only then, when we are asked to testify.

- Recertification is pretty routine - there is little new information.

- *Hippus and rebound dilation are two that cause a lot of problems in both teaching and in field certifications. We spend a lot of time in a dark room with the students trying to get them to recognize exactly what rebound and hippus are so they are not confused with movement of the eyelid, ambient lighting from another room, or light under the door or whatever. Those are all things that just come from experience more than anything else.*

Organizational Issues

There are several levels that contribute to the organizational issues associated with the DEC Program. There is state oversight and a national program that is supported by NHTSA through the IACP, but the DREs identified their local agency as the organization.

- *We have support of the agency, we have support of our department, but they don't have any knowledge, if I told them something about the DRE program, they're going to look at me like I was speaking a different language.*

- *I don't think accuracy is that big of an issue with them (agency), because they don't know how to tie the two together, they don't understand that as a DRE you have to make a call.*

Community Perceptions

For the DRE, the outside community includes prosecution, the courts, and the general public. They believe that the stakeholders that they are most concerned about are related to the prosecution of their cases. Although few cases make it to court as driving under the influence of a drug (DUID), many make it based on possession and other charges. It is from this viewpoint that the DREs offered the following information.

- *Those things (physical evidence) are great for making a case in court, so if they are good enough to be evidence in court, then you have to consider those when coming up with an indication of what the person is on.*

- *It's more like, 'You got a DWI off the street, good for you. Let me know how the prosecution goes'. All this stuff we do in between there is kind of a moot point with them.*

The DREs provided rich information in regards to the factors or combinations of factors that they consider or believe influence their predictions of a specific drug category(s) in a DIE. This information combined with the quantitative data from the actual DIEs serves to inform both the DEC Program specifically and HRD in general. By examining the individual performance data related to this process in terms of the theoretical frameworks of decision-making and the transfer of training, the research product can serve the community from both a practical and scholarly perspective. The researcher provides a detailed discussion of this approach in Chapter VI of this study.

Summary of Qualitative Findings

The results of the qualitative part of this study allowed the researcher to showcase the voice of selected DREs in relation to how they perceive selected factors or combinations of factors affect their decision-making. Each of the six DREs received the standardized DEC Program's practitioner training and two of the DREs had completed additional training to serve as instructors in the DEC Program in Texas. Each of the DREs had a slightly different approach to how they considered the observations they make when conducting a drug influence evaluation (DIE) in an enforcement situation. Based on the DRE's feedback, the researcher identified five separate themes, *The Truth is in the Eyes, SFSTs are the Key, Clinical Signs, Totality of the Evidence, and Quality Control: Accuracy and Oversight,* to assist the consumer of this research to understand the perceptions that the selected DREs held related to how they make their predictions of a drug category(s) after conducting a DIE.

The five themes were distinct based on the feedback from the DREs, but there were two factors that they identified as critical to their decision-making processes that the DREs equated with different themes. Pupil size was important to several DREs, but was attributed to the both *The Truth is in the Eyes and the Clinical Signs themes.* Additionally, horizontal gaze nystagmus (HGN) battery was associated with *The Truth is in the Eyes and SFSTs are the Key* themes. The *Totality of the Evidence* theme was a thread that weaved itself into each of the interviews on a frequent basis. One area, *Quality Control: Accuracy and Oversight,* served as an anti-theme of sorts. Each of the DREs acknowledged that quality control and oversight was critical especially in terms of courtroom testimony, but the DREs also noted that little oversight and quality control exists due to the few number of DIEs performed, funding limitations, infrequency of cases going to trial, lack of agency and state oversight, as well as the long delays related to the toxicology results.

The employment of qualitative methodology to this study yielded unique insights that can directly benefit the DEC Program by highlighting potential inconsistencies between what is taught as part of the standardized DEC Program training and the DRE's performance in the field. Additionally, this approach provides a model to evaluate other similar transfer of training situations so that a program or organization can glean comprehensive feedback on how individuals deploy standardized decision-making processes learned as part of a human resource development intervention such as training impacts performance. Subsequently, this feedback should inform the training process in order to attend to continuous improvement in the individual, process, organization, and community performance domains.

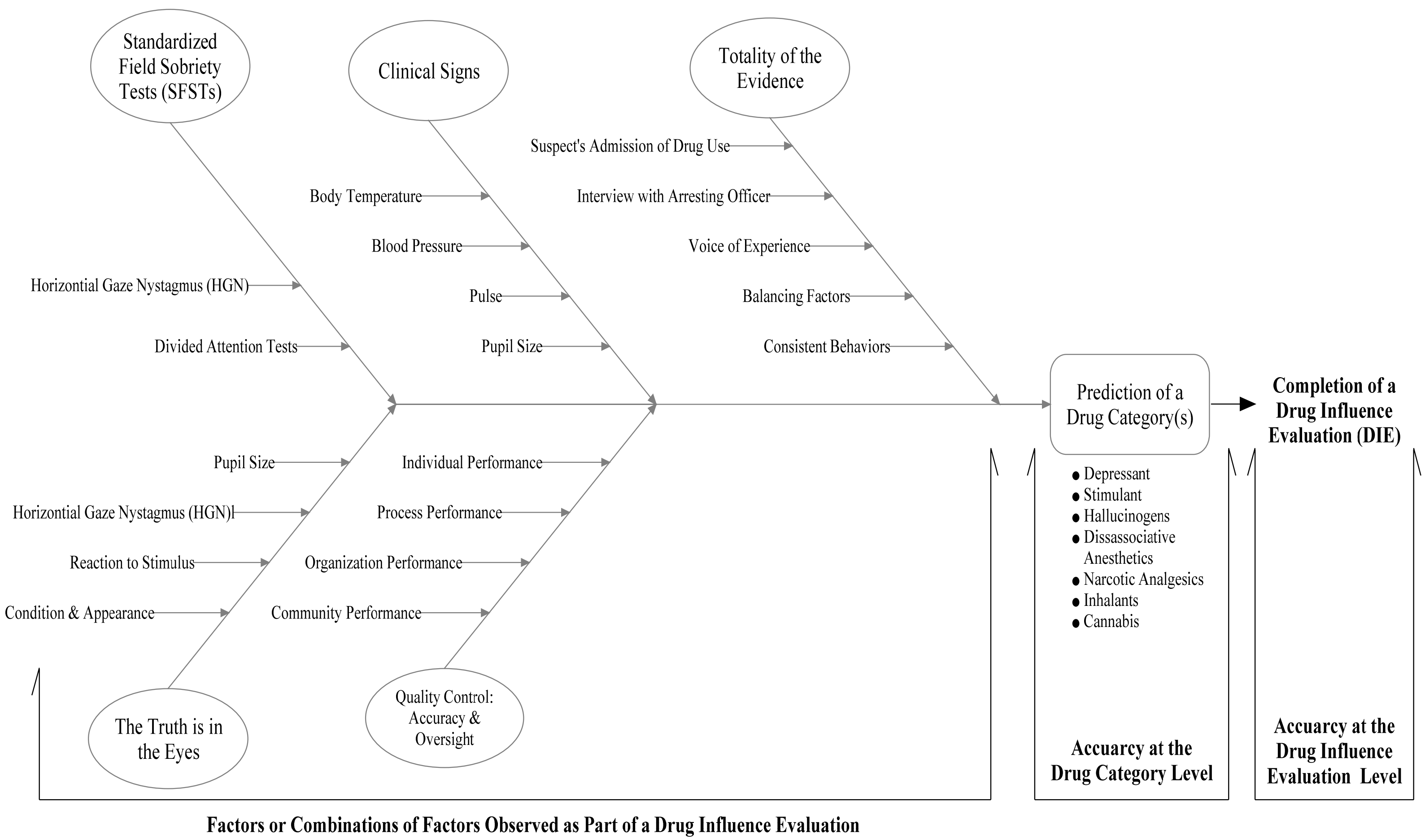
Integrating the Results of the Research Questions

The results of this study were discussed based on the research questions, but it is important to note that the questions were posed so that the consumer of this research could understand the broad concept of accuracy related to the DEC Program before examining how specific factors or combinations of factors might impact that accuracy. In order to appreciate the potential influence of these factors on the DRE's prediction of a drug category, it was important to identify those DIEs where the drug category was present. Next, the researcher calculated the frequency of occurrence for each factor according to category. This data format provided a discussion forum to glean information from the interviews with the six DREs.

The DRE completed a drug influence evaluation (DIE) after he or she determined whether the subject is under the influence of a drug or drugs other than alcohol. In order to determine which drug or drugs was responsible for the subject's impairment, the DRE considered the factors or combinations of factors observed as part of the DIE. The DRE predicted a drug category(s). The individual DRE's accuracy depends on whether the toxicology results confirm the presence of that drug category(s) in the subject's system at the time of the evaluation. The relationship between the observation of factors or combinations of factors and the prediction of a drug category(s) is illustrated in Figure 22.

The next level of accuracy takes into account all of the DRE's predictions of drug categories related to that specific DIE. Based on the criteria referenced in the Administrator's Guide for the DEC Program, if the DRE predicted one or two drug categories and at least one of those drug categories was confirmed by the toxicology results, then the DIE was considered correct. Additionally, if the DRE predicted three, four, five, six, or seven different drug categories and at least two of those drug categories were present in the toxicology results, then the DIE was considered correct.

Figure 22. Relationship Between Factors Observed by a DRE as Part of a DIE and the Prediction Accuracy at the Drug Category(s) and DIE Levels



It was interesting to hear the DREs discuss which factors or combinations of factors they perceived to have an influence on their prediction of a drug category. Some of their feedback was consistent with the results of the analysis of the quantitative data, while other assertions on the part of the selected DREs were not supported by the frequencies of occurrence of those factors in a particular drug category or, in some cases, across all 199 DIEs analyzed as part of this study.

Previous research related to the DEC Program was limited to the application of quantitative methods and focused on validating the decision-making process standardized through the 12-step process taught as part of the DRE's training. Validation of the DEC Program was aimed at determining the reliability a trained DRE employing the 12-step process to accurately predict a drug category. This study serves to support the use of the DEC Program as an acceptable means of assessing individuals suspected of being impaired by a drug or drugs other than alcohol in order to support criminal prosecution. Although this approach is necessary for the criminal justice system, limiting the research on the DEC Program that requires the significant investment of personnel and fiscal resources is short sited.

Traffic safety programs funded by state and federal resources require quantitative evaluation and often shy away from labor intensive qualitative approaches similar to those utilized in this study. The quantitative methods provided vehicle to examine accuracy in terms of percentages at both the drug category and drug influence evaluation levels. Additionally, the potential impact of the existence of selected factors was analyzed based on the frequency of occurrence when the drug was present and absent in the toxicology results. The qualitative results shed light on the perceptions that selected certified DREs had in regards to how selected factors or combinations of factors influenced their decision-making related to a DIE.

Since the DREs learn to assess individuals suspected of being impaired on a drug or drugs other that alcohol by completing a standardized, intensive training and employing the same 12-step process in the enforcement environment, it is important to look at the quantitative data as well as listen to the voices of those who are producing that data. The DEC Program seeks to maintain standardization, therefore it is critical from the stakeholder's viewpoint to have consistency between what the DRE perceives as important to their decision-making process and which factors actually contribute to an accurate prediction of a drug category(s). Establishing that level of understanding would only be accomplished by employing both quantitative and qualitative methods to examine how DREs use the decision-making process that was learned as part of a standardized training program, DEC Program, impacts performance. In the following chapter, Conclusions, Implications, and Recommendations, the researcher summarizes the conclusions draw from the quantitative and qualitative findings. Additionally, the researcher highlights implications for the DEC Program and how this study can be used to justify the employment of human resource development applied theories and models to improve the DEC Program. Finally, the researcher will offer recommendation for application of the study results to improve performance in the DEC Program as well as identify opportunities for future research.

CHAPTER VI

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

This study was separated into six chapters: *Introduction*, *Review of Literature*, *Methodology*, *Quantitative* and *Qualitative Data Analysis and Results* as well as *Conclusions*, *Implications and Recommendations*. In the first chapter, *Introduction*, the researcher articulated the purpose of the study and defined the research questions based on the problem statement. Additionally, the researcher demonstrated how the problem of examining the decision-making factors influencing performance of the drug recognition expert (DRE) utilizing the Drug Evaluation and Classification (DEC) Program to identify suspected impaired drivers was a human resource development (HRD) problem. In the second chapter, *Review of Literature*, the researcher examined three constructs, transfer of training, decision-making, and the DEC Program, through the literature in order to inform the problem.

In the third chapter, *Methodology*, the researcher considered a number of theoretical paradigms to serve as a framework for this study, but selected postpositivism as the most appropriate considering the available data and the stakeholders associated with the DEC Program. Additionally, the researcher identified questions, strategies, and methods, along with statistics and techniques to address the needs of this study. The fourth chapter, *Quantitative Data Analysis and Results*, provided the opportunity for the researcher to detail the results associated with the first two research questions from a quantitative perspective. First, the researcher analyzed the data based on the accuracy of the DRE in regards to their prediction of a drug category(s) at the drug influence evaluation (DIE) and individual drug category levels. Second, the researcher examined how factors or combinations of factors that may influence a DRE's prediction based on the frequency of occurrence when the drug category is present and not present.

In the fifth chapter, *Qualitative Data Analysis and Results*, the researcher summarized the qualitative data captured through interviews with selected DREs. These data served to inform the third research question related to the DRE's perceptions in regards to the factors or combinations of factors the influenced their prediction of a drug category. Since the analyses were conducted using both quantitative and qualitative approaches, the consumer of this research can gain a more holistic understanding of the problem from DIE data and the direct feedback from the DREs as to their decision-making criteria. In this final chapter, *Conclusions*, *Implications and Recommendations,* summarizes the study and draws conclusions based on the quantitative and qualitative results.

Although the employment of mixed methods was cumbersome and time consuming, the results yielded informative conclusions. The quantitative findings helped to identify opportunities to improve the accuracy at the drug category level through better understanding of how the factors influence decision-making. In contrast, the researcher also needed to pay attention to the interview data since sometimes it appears to be in conflict with the quantitative data and the training. This contradiction is not detrimental to the DEC Program, but rather highlights opportunities to improve the transfer of training process. Additionally, the implications for HRD in terms of transfer of training and decision-making in general as well as for the DEC Program in particular are discussed in this chapter. The researcher closes this chapter with recommendations for the development of potential manuscripts based on the results of this study as well as suggestions for future research related to the transfer of training and the DEC Program.

Summary of the Study

This study was a postpositivistic inquiry that used mixed methods to identify and examine which factors or combinations of factors may influence a DRE's accurate prediction based on their training of a drug category(s) after conducting a DIE in an enforcement situation. The study used quantitative data from drug influence evaluations (DIEs) previously collected for an unrelated project. Additionally, qualitative data collected through interviews conducted exclusively as part of this project was analyzed the DRE's perceptions as to what factors influence their predictions as well as inform the purpose of this study.

Although DEC Programs exist in a number of states, the scope of this study was limited to DIEs conducted in Texas during enforcement activities and feedback from DREs who are currently certified in the state by Texas DEC Program. Sam Houston State University's Criminal Justice Center on behalf of the Texas Department of Transportation (TxDOT) manages the Texas DEC Program. The National Highway Traffic Safety Administration (NHTSA) and the International Association of Chiefs of Police (IACP) provide oversight at the national level.

Use of Mixed Methods

The employment of mixed methods in this study provided the researcher with the opportunity to not only utilize quantitative data to analyze performance, typical for research related to the DEC Program, but also introduce valuable qualitative data gleaned directly from those individuals who are charged with employing the standardized 12-step decision-making process. This approach provided representation for the perceptions of the selected DRE.

As a result of using a mixed methods approach, the consumer of this research can consider the impact of the transfer of training from a frequency of occurrence perspective on the use of factors or combinations of factors in a DRE's prediction of a drug category. Interpretation of this type of data could lead the reader to assume that if a factor(s) is present and that factor(s) is associated with a drug category(s) then the DRE will predict the drug category. Since DREs are individuals who bring a wealth of experiences to their decision-making both from a conscious and sub-conscious manner, it is not practical to simplify the DRE's prediction of a drug category to an *if-then-else* decision-making process. For this reason, the researcher believed that it was critical to interview selected DREs to understand how the factors or combinations of factors observed as part of the 12-step decision-making process may influence their prediction of a drug category(s).

There were two sets of participants in this study. The DIEs that met the criteria for inclusion in the study determined the participants in the first part of the study. The DREs completed the DIEs include in this study between January 1, 2002 and December 31, 2004 and were confirmed by toxicology results. The DRE completed each DIE as part of an enforcement action as opposed to a training activity. Additionally, the DIE did not result in an alcohol or medical rule out. The researcher drew the DIEs from a larger pool of evaluations that were submitted voluntarily by Texas DREs for inclusion in a national database created on the behalf of NHTSA. The researcher selected the DIEs based solely on the previously stated criteria without regard for the identity or background of the certified DRE who completed it. One hundred and ninety-nine DIEs met the criteria for inclusion in the study.

The second set of participants contributed to the qualitative data collected to address the third research question. The researcher selected six DREs to participate in semi-structured interviews that were conducted to examine which factors or combinations of factors the DRE perceived as influencing their ability to accurately predict a drug category(s) after completing a DIE. The DREs were selected purposefully using recommendations from the previous interviewees in order to obtain feedback from those they believed to have similar and/or divergent experiences as DREs.

The interviews yielded rich data that served to inform the results from the second research question that examined the frequency of those same factors or combinations of factors occurring when a drug category(s) was present in a DIE. The interviews lasted twenty-five minutes, on average, and were audio recorded, transcribed, and analyzed to yield five primary themes. The researcher identified themes based on the qualitative in order to inform the third research question.

Summary of Findings

The three research questions had different functions in regards to addressing the purpose of this study. The first question examined the DRE's prediction accuracy, which followed by the second question's investigation into factors or combinations of factors that may contribute to that accuracy rate. The quantitative questions preceded the qualitatively based third research question, which sought to understand how selected DREs perceived those same factors influence their prediction of a drug category(s). The researcher summarized the results of the three research questions in Table 33.

Table 33. Summary of the Findings

Research Question	Findings
1. To what extent do the drug recognition expert (DRE) predictions of a drug category(s) agree with the toxicology results?	1) DREs classified correctly 176 of the 199 or 88.4% DIEs examined as part of this study 2) 96 (48.2%) of 199 were classified completely correct a. 56 of the 96 DIEs involved only one drug category b. 40 of the 96 DIEs involved more than one category 3) An additional 80 (40.2%) DIEs were classified as correct based on the DEC Program standards 4) DREs classified 23 (11.6%) of 199 incorrectly a. 14 DIEs had predictions of only one drug category i. 10 of those showed no drug present in the toxicology results 5) Of the 199 DIEs, DREs predicted one drug category 55.8% of the time a. Only 36.2% of the DIEs showed one drug category in the toxicology results 6) Individual drug category accuracy rates were as follows (number in the brackets (#) indicates the number of DIEs where the drug category was present on the toxicology report): a. Depressants (106) – 82.9% b. Stimulants (56) – 80.9% c. Dissociative Anesthetics (13) – 96.5% d. Narcotic Analgesics (74) – 81.9% e. Cannabis (89) – 82.9% f. Hallucinogens and Inhalants lacked enough observations to be included in the analysis 7) Quadrant IV of the Chi-square table (DRE did not predict the drug category and it was not present on the toxicology report, also considered a no call) was over represented in the frequency counts for the observed values therefore contributing significantly to the overall accuracy rates

Table 33. Continued

Research Question	Findings
2. In terms of drug categories, what factors or combinations of factors have potential influence on the accuracy of the DRE's prediction when compared to the toxicology results?	1) There were 29 different factors or combinations of factors considered as part of the 2nd research question a. Each factor had an expected observation according to category b. Each factor had an observed frequency recorded when the drug category **was present** in the toxicology results c. Each factor had an observed frequency when the drug category **was not present** in the toxicology results 2) Depressants (106 DIEs had a depressant present in the toxicology results) a. Poor coordination 85.8% b. Slurred speech 77.4% c. HGN 84.0% 3) Stimulants (56 DIEs had a stimulant present in the toxicology results) a. Excessive sway during the Romberg test was observed in 57.1% of the DIEs with a stimulant present b. Nasal cavity was observed to be red and/or inflamed in 30.4% of the DIEs 4) Dissociative Anesthetics (DA)(13 DIEs had a DA present in the toxicology results) a. HGN observed in 92.3% of the cases b. Average clues on HGN was 5.38 c. 84.6% of the subjects performed poorly on the walk-and-turn test d. Average summary of pulses was 273.92bpm compared to 264.93bpm when DA is not present 5) Narcotic Analgesics (NA)(74 DIEs had a NA present in the toxicology results) a. Slurred speech was observed in 79.7% of the DIEs with NA present b. Poor performance on the walk-and-turn in 94.6% and on the one-leg stand in 83.8% of DIEs with a NA present c. Constricted pupils observed in 39.2% of DIEs with a NA present as opposed to 8% when a NA was not present

Table 33. Continued

Research Question	Findings
	6) Cannabis (89 DIEs has cannabis present in the toxicology results) a. Marked reddening of the conjunctiva was present in 73.0% of the DIEs when cannabis was present b. Pupils were dilated in 74.2% of the DIEs where cannabis was present c. Debris was observed in 84.3% of the DIEs when cannabis was present on the toxicology results d. Rebound dilation occurred in 42.7% of the DIEs where cannabis was present as opposed to 15.5% when it was not 7) Lack of convergence was present in more than 90% of the DIEs regardless of category a. The pupil size factor provided conflicting information regardless of category b. Pupils tended to be dilated especially in near total darkness condition c. Pulse rates tended to be high regardless of category d. Consistent between summary of pulses and DRE pulse factors

Table 33. Continued

Research Question	Findings
3. Based on their experiences as DREs, what do selected DREs perceive as influencing their ability to accurately predict a drug category(s)?	1) Findings based on the data collected from six selected DREs in Texas 2) Emergence of five primary themes and various subthemes a. The truth is in the eyes b. Clinical signs c. Standardized field sobriety tests (SFSTs) are the key d. Quality control: Accuracy and oversight e. Totality of the Evidence 3) Similarities between qualitative data and quantitative findings a. Eye reactions (rebound, HGN, reaction to light, etc.) b. Performance on the walk-and-turn and one-leg stand tests c. Speech difficulties 4) Inconsistency between qualitative feedback from DREs and frequency of occurrence for selected factors a. Pulse was cited as a critical factor among the DREs interviewed, but no practical difference across categories for this factor b. Pupil size was mentioned by all the participant DREs, but the readings were not always consistent with the expected observation across drug categories 5) Quality Control theme highlighted information not captured through quantitative data a. Impact of minimal direct oversight in regards to accuracy b. Delayed feedback from toxicology results 6) Totality of the Evidence theme demonstrated that factors not directly related to the 12-step process influenced DRE predictions a. Knowledge from other training and enforcement experience b. Evidence from vehicle search c. Driving facts

Conclusions

This study yielded three primary outputs: DRE accuracy rates for a sample of drug influence evaluation s (DIEs), frequency of occurrence of factors or combinations of factors according to drug category(s), and DRE perceptions of which factors or combinations of factors influence correct predictions of categories. The conclusions from these primary outputs are discussed in the following section.

DRE Predictions of a Drug Category(s) Compared to the Toxicology Results

The first research question examined to what extent did the drug recognition experts (DRE) prediction of a drug category(s) agree with the toxicology results. The rate at which the DRE's predictions agree with toxicology results is expresses at two levels: DIE and drug category. After a DRE completes a DIE, they make a prediction, based on their observations; of the drug category(s) that they believe are impairing the suspect. The DRE's prediction at the DIE level may include up to seven drug categories. The accuracy rate associated with the DIE represents the DRE's ability to classify all the drug categories appropriately. In addition to the DIE level, the study examined the accuracy at the individual drug category level. This accuracy rate reflects the DRE's performance related to a specific drug category in isolation from the other drug categories. The conclusions related to this research question are presented according to these two levels.

Accuracy at the Drug Influence Evaluation (DIE) Level

Based on the data set analyzed as part of this study and criteria defined by the DEC Program's Administrators Guide, the Texas DREs had a good overall accuracy rate for DIEs as well as individual drug categories. In order for a DIE to be correct, the DRE must have their predictions confirmed by the toxicology results according to the criteria summarized in Table 34.

Table 34. Accuracy Criteria For DRE's Predictions at the DIE Level

DRE Predicts	Toxicology Confirms
One Drug Category	Predicted Drug Category Present in the Toxicology Results
Two Drug Categories	One of the Two Predicted Drug Categories Present in the Toxicology Results
Three Drug Categories	Two of the Three Predicted Drug Categories Present in the Toxicology Results
Four Drug Categories	Two of the Four Predicted Drug Categories Present in the Toxicology Results
Five Drug Categories	Two of the Five Predicted Drug Categories Present in the Toxicology Results
Six Drug Categories	Two of the Six Predicted Drug Categories Present in the Toxicology Results
Seven Drug Categories	Two of the Seven Predicted Drug Categories Present in the Toxicology Results

According to the DIEs evaluated as part of this study by utilizing the DEC Program accuracy criteria, the DREs classified the DIEs correctly 88.4% or the time. In other words, 176 of the 199 DIEs were correct according to the DEC Program accuracy criteria. Of those 176 DIEs, 96 DIEs were classified as completely correct meaning the DRE predicted the exactly the same drug categories that were present in the toxicology results. Fifty-six on those 176 DIEs were correct according to the DEC Program standards, but the DRE's predictions were not completely consistent with the toxicology results. Interestingly, 58.3% of those DIEs classified as completely correct involved only one drug category. Only 23 of the 199 DIEs included in this study were incorrect. Of those 23 incorrect DIEs, the DRE predicted only one drug category in 14 of those cases and 10 of those showed no drug present in the toxicology results.

Accuracy at the Drug Category Level

At the program level, nationally and statewide, the DEC Program often quotes prediction accuracy at the drug category levels. Traditionally, the DEC Program calculated accuracy rates at the drug category levels from data contained in the national DRE Tracking System, an online, secure database that NHTSA developed to allow states to analyze DIE data. The DEC Program also uses this database to measure performance across all DEC Program states. In most states, including Texas, the input of the DIE data is not mandatory. Therefore, the DEC Program calculated accuracy rates based on voluntarily submitted data that may not reflect a true representation of the DEC Program's performance. Often, the DREs enter the DIEs into the database without toxicology results. A shortage of laboratory resources frequently delays the release of toxicology reports. It is the responsibility of the individual DRE to enter the toxicology information into the database. If the DEC Program, statewide or nationally, wants to utilize the NHTSA DRE Tracking System for the purpose of calculating accuracy rates, then stricter quality control standards must be incorporated to ensure that the DIE information entered into the DRE Tracking System is representative of the DIEs being conducted in the each of the DEC Program states. A summary of the overall accuracy rates is detailed in Table 35.

Table 35. DRE Prediction Accuracy According to Drug Category

Drug Category	n[1]	Prediction Accuracy[2]
Depressants	106	82.9%
Stimulants	56	80.9%
Dissociative Anesthetics	13	96.5%
Narcotic Analgesics	74	81.9%
Cannabis	89	82.9%

Note: Hallucinogens and Inhalants did not have enough observations to be included in the analysis
[1]Column *n* indicated the number of DIEs with that drug category present in the toxicology results
[2]Prediction accuracy was calculated based on the number of DIEs where the DRE predicted that drug category and it was present in the toxicology results and the number of DIEs where the DRE did not predict that drug category and it was not present in the toxicology results divided by the total DIEs (199)

The accuracy rate performance measures associated with the drug category level can be useful to the DEC Program, but caution should be exercised when generalizing this information in an effort to describe the effectiveness of the whole program. There are two issues related to a drug category's accuracy rates that need to be taken into account: how accuracy rates are calculated and the impact of poly drug use on accuracy rates for individual categories. A DRE's prediction is correct if the DRE predicts the drug category and that category is present in the toxicology results or if the DRE does not predict the drug category and that category is not present in the toxicology results. The latter criterion is defined as a *no call*.

Since the not predicted-not present DIEs are included in the numerator of the accuracy equation, the consumer of this research as well as other stakeholders of the DEC Program must take a closer look at how this calculation affects actual performance. Although it is reasonable to include the *no calls* as accurate decisions, it can also provide an overly optimistic view of the prediction accuracy of the individual DRE, the 12-step decision-making process, and the DEC Program as a whole in respects to the individual drug categories. In order to improve the transfer of training into performance relative to the DEC Program, those administering the program and providing training need to look at trends that may occur related to incorrect predictions. For instance, if the DREs frequently observe hippus or constricted pupils when categories other than narcotic analgesics are present, then the program may want to focus on how the DREs are assessing these factors when conducting a DIE. Fortunately, DREs are required to attend recertification training on a bi-annual basis, so the program has frequent opportunities target deficient areas through these recertification activities. The DEC Program needs to take the opportunity to analyze performance data beyond the drug category's accuracy rate in order to improve performance by addressing driving factors that influence those accuracy rates.

As previously discussed, it is important to look at the factors that may drive incorrect predictions so that the transfer of training is improved. For example, the accuracy rate of the Stimulant Category was determined to be 80.9%, but there were more DIEs where the DRE did not predict the category when it was present than when the DRE predicted the category when it was present. There are several reasons this phenomenon might occur. Suspects on the down side of the stimulant tend to mimic a depressed state that may be mistaken for another drug category. This information provides a great deal on insight especially when combined with the DRE's feedback related to this type of observation reported during the interviews associated with the third research question. Without looking beyond the drug category's overall accuracy rate to the individual cells, the DEC Program is at risk of ignoring valuable performance information that can inform the transfer of training not only during the DRE's initial training, but also in the recertification courses required bi-annually.

Based on the 199 DIEs included in this study, the DREs predicted only one drug category 55.8% of the time. In contrast, only 36.2% of the DIEs had one drug category present in the toxicology results that indicates that the DRE should be conscious of the fact that many individuals who they evaluate may be under the influence of more than one drug. Additionally, DREs may only predict one drug because they did not observe the signs and symptoms consistent with other categories or a drug category that was present in the toxicology report was not observed to be psychoactive at the time of the evaluation.

Factors Influencing DRE Accuracy When Compared to Toxicology

The objective of the second research question was to examine the potential influence of the different factors or combinations of factors considered by the DRE during the 12-step process employed as part of the DIE. The researcher defined each factor according the DEC Program's training materials and included the expected observation according to the drug category for each factor. As part of the data analysis for each drug category, the researcher calculated the observed frequency for each factor when the drug category *was present* in the toxicology results as well as when the drug category *was not present* in the toxicology results. This frequency analysis provided practical information as to the factors or combinations of factors commonly observed when a particular drug category was present These frequencies were compared to the information provided in the DEC Program's training materials (See Appendix B - DEC Program Drug Category Matrix).

Frequently Occurring Factors or Combinations of Factors According to Drug Category

The Depressant Category was present most often with 106 DIEs having a depressant present in the toxicology results. The most frequently observed factors for this drug category was poor coordination (85.8%), slurred speech (77.4%), and HGN

(84.0%). These observations are consistent with the training associated with the DEC Program.

According to the toxicology results, the Stimulant Category was present in 56 DIEs. The most frequently observed factors when a stimulant was present included excessive sway during the Romberg test (57.1%) as well as red and/or inflamed nasal cavity (30.4%). The DREs did not predict the Stimulant Category when it was present in the toxicology results in 34 of the 56 cases. This statistic may indicate that the signs and symptoms that are consistent with a stimulant, according to the DEC Program, are frequently not present when a DRE conducts a DIE even when the drug category is present in the toxicology results. This situation may be due to the short duration of effects associated with many drugs included in the Stimulant Category. Although this information is part of the DEC Program training, these results may indicate the need to enhance the training in regards to this specific drug category. The DREs who participated in the interviews connected to the third research question offered some specific feedback related to this issue.

The Dissociative Anesthetic Category was present in the least number of DIEs. Thirteen DIEs had a dissociative anesthetic present in their toxicology results. Of those cases, HGN was observed 92.3% of the time and the average number of clues on HGN were 5.38. The DRE's feedback through the interview process also indicated that the immediate onset of HGN during the *onset prior to 45^o* portion of the test was a strong indicator of dissociative anesthetic use. The other factors frequently observed included poor performance on the walk-and-turn test in 84.6% of the cases and the average on the summary of pulses was 273.92 beats per minute (bpm) compared to 264.93 bpm when a dissociative anesthetic was not present the toxicology results. These finding are consistent with the DEC Program training as well as the feedback from the qualitative data collection and analysis.

Drugs associated with the Narcotic Analgesic Category were present in 74 DIEs of the 199 DIEs included in this study. The factors or combinations of factors most frequently observed when a narcotic analgesic was present in the toxicology results were slurred speech (79.7%), poor performance on the walk-and-turn (94.6%) and one-leg stand (83.8%) tests, as well as constricted pupils in 39.2% of the DIEs with a NA present as opposed to 8% when a NA was not present. These findings are consistent with the DEC Program training and the DRE's interviewed cited these as indicators of narcotic analgesic use.

Cannabis was identified as present in the toxicology results in 89 of the 199 DIEs. Common factors observed included marked reddening of the conjunctiva (73.0%), dilated pupils (74.2%), and debris in the oral cavity (84.3%) as well as rebound dilation in 42.7% of the DIEs where cannabis was present as opposed to 15.5% when it was not. These observations are consistent with the feedback from the DRE's interviewed during the qualitative part of this study as well as by the training materials associated with the DEC Program.

Inconsistent Occurrence of Factors or Combinations of Factors

There were several factors where the frequency data did not provide any practical indication that the factor could positively influence a DRE's prediction of a specific category. The first instance of that was with the lack of convergence factor that was present in more than 90% of the DIEs regardless of category. In recent revisions of the DEC Program training materials, the techniques were changed to assess the lack of convergence to make the test a more robust indicator of drug impairment. There is no way to know how this change may have affected the decision-making of the DREs who conducted the DIEs included in this study, but it may help to explain why there was no practical difference in the frequency of occurrence across categories. Secondly, the pulse rates, both as a summary factor and as individual observations, tended to be high regardless of category. The six selected DREs mentioned that the pulse rate factor was also a clear indicator of impairment.

Pupil size was an additional factor that did not provide information that appeared useful to the DRE in discerning which drug category was contributing to an individual's impairment. This conclusion was surprising considering the value that the selected DREs, interviewed as part of the third research question, placed on the eyes, especially pupil size, in predicting a drug category(s) during a DIE. The pupil size factor provided conflicting information regardless of category. The pupils tended to be dilated especially in near total darkness condition. When these DIEs were conducted, the criteria for the pupil size factors were the same for all three lighting conditions: constricted pupils measured less than 3.0mm, normal pupil measures between 3.0 mm and 6.5 mm, and dilated pupils measured over 6.5mm. Recent changes in the training materials modified the normal ranges for pupil size in accordance with specific lighting conditions. The new ranges may have resulted in different observations on the part of the DRE and provided a more robust factor for the DIE process. Although it might be interesting to apply the revised ranges to the data set to see if the pupil size factors presented observations that were more consistent with the DRE's training, using those revised ranges would not represent the information available to the DRE at the time they made their original prediction.

Individual Capacity of Considering Multiple Factors in DEC Program Decision-Making

Previous research pertinent to the DEC Program as well as the literature related to decision-making processes indicated that an individual has a limited capacity to consider inputs or factors them making a decision, drawing a conclusion, or solving a problem (Heishman, Singleton, & Crouch, 1996, 1998; Shinar & Schechtman, 2005). Some of the DEC Program literature suggests that subsets of factors are reliable indicators for impairment associated with specific drug categories. This assertion was based on quantitative analysis of laboratory data related to single drug category evaluations.

These findings are supported by the more general conclusions referenced in the field of decision-making. Although the DEC Program is a standardized process, an open-system maintains a sense of organization regardless of the internal and external influences (Checkland & Tsouvalis, 1997; Landau, 1997). The DEC Program system relies on the procedural knowledge, skills, and attitudes through the DRE gained in training. The integration of the training with the DRE's experiences influences that system and, therefore, affects the DRE's decision-making process. These influences or heuristics are responsible for the DRE's reliance on a subset of these factors to make their prediction of a drug category(s) since the DRE cannot effectively process all these factors during their decision-making process (Heishman, Singleton & Crouch, 1996, 1998; Shinar & Schechtman, 2005). The key in the DEC Program is to identify which factors or combinations of factors provide the most credible information to the DRE. This analysis provides one perspective as the best factors to consider.

DRE Perceptions of What Influences Their Prediction of a Drug Category

Through the third research question, the researcher wanted to discover, based on their experiences as DREs, what selected DREs perceived as influencing their ability to accurately predict a drug category(s) after conducting a drug influence evaluation (DIE). There were six certified Texas DREs selected to participate in this study. The six DREs included three DRE instructors and three DRE practitioners. The researcher selected the first DRE based on the researcher's previous experience with the Texas DEC Program as well as input from the DEC Program management. After the first interview was completed, the researcher asked the DRE to suggest three individuals who had similar DRE experiences to them and three that the participant believed to have different experiences. The researcher advised the participants that experiences could mean, but were not limited to, agency type or size, experience in the DEC Program, DRE instructor or practitioner, and geographic location. The researcher repeated this process with each of the six DREs interviewed as part of this study. Multiple participants mentioned several of the same DREs. This phenomenon did not surprise the researcher since the DREs are a specialized, well-connected community within Texas law enforcement and more specifically traffic enforcement.

DRE Interviews

The researcher used a semi-structured format to interview each of the six selected DREs. The interviews averaged thirty minutes in length. The researcher documented each interview using a digital audio recorder and researcher notes. The researcher transcribed the interviews were transcribed and each participant was given the opportunity to review the written documentation. The data collection, as part of the third research question, informed the quantitative data gathered as part of the first two research questions. From the results, five themes along with additional subthemes emerged:

- The Truth is in the Eyes
- Standardized Field Sobriety Tests (SFSTs) are the Key
- Clinical Signs
- Totality of the Evidence
- Quality Control: Accuracy and Oversight

The most interesting aspect of identifying the themes was that the manner in which the DRE's discussed factors and combinations of factors dictated the development of all but one theme. The Quality Control Theme emerged indirectly from the quantitative and qualitative data; this theme does not speak directly to the use of the factors or combinations of factors in the DRE's decision-making process, but rather the outside influences that may affect accuracy. The subthemes related to quality control centered on the feedback to the DRE and paralleled issues related to the transfer climate in the literature. With respect to the DRE, feedback manifests itself in several ways: toxicology results, agency support, state program communication, and response from the criminal justice system.

Linking Transfer of Training to DRE Learning and Performance

Scholars identify critical components to training that affect transfer of training in many different ways, but most perspectives boil down to the following (Ellis, 1965; Olson, 1998):

- Similarity of training to the task(s) that are expected to be performed
- Opportunities for practice and application during training
- Integration of scenarios that closely match the work setting
- Feedback on performance in both the training and work environments

The first three components address the training and transfer design inputs in Holton's (1996) transfer of training model. The fourth component speaks to the issues related to transfer climate. These components, combined with the individual's motivation to transfer, provide a general framework for transfer of training in various environments.

"Learning and training interventions do not exist in a vacuum, but are part of a larger performance system" (Burke & Hutchins, 2007, p. 280). The literature reveals that when the application of the knowledge, skills, and attitudes learned as part of training interventions is valued, the participant will be encouraged to apply that training (Baldwin & Ford, 1988; Burke & Hutchins, 2007; Richman-Hirsch, 2001; Yamnill & Mclean, 2001). The amount of support received has a positive, direct effect on the individual's motivation to transfer the training into job performance. In the case of the DEC Program, the encouragement not only comes from the toxicology results, but also from independent sources both internal and external to the performance system. These systems influences can create a transfer climate that values accuracy on the part of the DRE and demonstrates that value by actively tracking DRE performance at the individual, agency, state, and national level and communicating those results. Additionally, this attention to performance can bolster the acceptability of the individual DRE and the process in the court system. This type of feedback is also a vital element in an environment or climate that values continuous improvement at the system level. The six selected DREs reported that feedback at all levels is sporadic and their impression of DRE performance was based on their individual, anecdotal knowledge and/or perceptions.

Conclusions in Terms of Themes

There were several similarities between qualitative data and quantitative findings as well as across themes. The factors associated with the reaction of the eyes, rebound dilation, HGN, and reaction to light, were frequently observed in the appropriate drug categories as defined in the DEC Program training materials. Additionally, these factors were cited in all themes developed as part of the qualitative analysis except *Quality Control*. Performance on the walk-and-turn and one-leg stand tests was also a commonly observed factor in the quantitative data as well as being considered a subtheme in the *SFSTs are the Key* and the *Totality of the Evidence* themes. Difficulties with speech, slurred and rapid, was present in the frequency data as well as conveyed through the interviews.

Inconsistency between qualitative feedback gleaned from DREs and frequency of occurrence for selected factors included factors associated with pulse and pupil size. As previously discussed in regards to individual drug categories, the DREs indicated that factors associated with the eyes were a critical factor in their decision-making. In contrast, the quantitative results were not always consistent with the expected observations across drug categories that make it difficult to reconcile with the input from the selected DREs. The DRE’s cited pulse as a critical factor among the DREs interviewed, but no practical difference was apparent across categories for this factor.

The *Quality Control* theme highlighted information not captured through quantitative data. The selected DREs reported that there is minimal direct oversight or feedback in regards to accuracy. One of the issues related to this problem is the extensive delays in receiving toxicology results. The DREs are not required to input their DIEs and subsequent toxicology results into the national database. Such information could provide information in regards to accuracy rates at the DIE and drug category levels, but would not afford the valuable data at the factor level. The lack of systemic quality control contributes to the transfer climate associated with the DEC Program training.

The *Totality of the Evidence* theme confirmed that factors not directly related to the factors or combinations of factors observed as part of the 12-step process influenced DRE predictions. Several interview participants indicated that they had received other training related to drugs and drug impairment. These participants indicated that the supplemental training along with enforcement experience related to drug offences other than impaired driving allowed them to be more aware of evidence in addition to the behavior of the suspect. Additionally, all of the participants indicated that physical evidence from searching the vehicle or the individual provided strong indications as to the drug category(s) that may be influencing the suspect's behavior. Lastly, the participants cited the driving facts and the observations of the arresting officer as useful facts to inform their prediction of a drug category(s). The overarching item related to the *Totality of the Evidence* theme was the DRE's belief that they have to look at the whole picture, not just the sum of the parts or factors, prior to making a prediction of a drug category.

Implications for HRD and the DEC Program

"Training is the most significant human resource function undertaken by law enforcement agencies" (Della, 2004, p. 1). The majority of law enforcement focuses on cognitive outcomes and ignores or marginalizes affective outcomes (Della, 2004; Picard, Papert, Bender, Blumberg, Breazeal, Cavallo, Machover, Resnick, Roy & Strohecker, 2004). It is important for the field of law enforcement to appreciate how the complexities of both types of outcomes were intertwined with the recall of knowledge and skills as well as decision-making. HRD, as a field and a process, can significantly contribute to the unleashing of human expertise through training to improve performance in the DEC Program.

In regards to this study, the DEC Program was designed to develop and unleash expertise by training law enforcement officers to effectively identify and assess drivers who may be under the influence of drugs other than alcohol. In the process of becoming a DRE, the officer gains knowledge, skills, and attitudes that prepare them to improve their performance in detecting impaired drivers. Based on that perspective, the problem of examining the decision-making factors influencing performance of the DRE utilizing the DEC Program to identify suspected impaired drivers becomes an issue that warrants solving from an HRD point of view.

This study provided a practical application to HRD in terms of the transfer of training and the deployment of decision-making skills because of that training. By applying Holton's (1996) model of transfer of training to the DEC Program in reverse, we can use the results of the quantitative and qualitative analysis to inform the model's inputs and work to optimize the process of transfer if we think of this process as a system.

Transfer of Training as a System

A system is and entity that seeks to maintain some level of organization in the face of internal and external forces while trying to convert something into a product (von Bertalanffy, 1968). The product can be used inside or outside the system's environment. Holton's (1996) model offers a system to explain the phenomenon of transfer of training and learning. The DEC Program is one example of one such transfer of training system. The results of the quantitative data analysis showed the extent to which DREs can accurately predict a drug category using the 12-step decision-making process learned in the DEC Program training.

The accuracy rate provides information related to the transfer design since we assume that the DRE's use a scientifically validated process to assist them in predicting a drug category(s). The results from this study show that the training and the transfer process provide a relatively effective means for the DRE to identify a drug category(s) after completing a DIE. The DEC Program must continue to review not only the accuracy and consistency of the training materials, but also analyze their effectiveness relative to the learner and the application environment. The DEC Program requires a recertification bi-annually that provides the program with opportunities to enhance performance through these periodic learning activities.

Calculating the Accuracy Rates

The researcher calculated the accuracy rates for the DEC Program based primarily on drug categories. A Chi-square table or contingency table was used to show clear representation of the results. The percent accurate is the sum of Quadrant I (predicted by the DRE and present in the toxicology results (See Figure 23) and Quadrant IV (DRE did not predict the drug category and it was not present on the toxicology report, also considered a no call) divided by the total number of DIEs in the sample. Although this calculation may be accurate, it is not clear-cut since it assumes that the DRE makes a conscious choice not to select the drug category.

Figure 23. Extent to which DRE Predictions Agree With Toxicology Results

		Prediction of the DRE	
		Predicted by DRE	**Not Predicted by DRE**
Toxicology Results		**Quadrant I**	**Quadrant II**
	Present in Toxicology Results	***Predicted*** by DRE **AND** ***Present*** in Toxicology Results	***Not Predicted*** by DRE **But** ***Present*** in Toxicology Results
		Quadrant III	**Quadrant IV**
	Not Present in Toxicology Results	***Predicted*** by DRE **But** ***Not Present*** in Toxicology Results	***Not Predicted*** by DRE **AND** ***Not Present*** in Toxicology Results

The frequency counts for the observed values for the drug categories were over represented in Quadrant IV of the Chi-square table. This phenomenon contributed significantly to the overall accuracy rates for most of the drug categories. The researcher is not suggesting that the DEC Program or the consumer of this research dismiss the accuracy rates advocated by the DEC Program, but in order to improve performance and the transfer of training, it would be useful to look beyond the percentage accuracy and examine all four quadrants of the Chi-square tables for each drug category. Without doing so, the DEC Program is at risk of developing a displaced sense of confidence that the training is completely effective and miss opportunities for improvement.

In addition to the overall accuracy results, the program should seize the opportunity to examine the potential influence of the factors or combinations of factors, observed as part of a DIE, have on the DRE's prediction accuracy at the drug category level. Although the 12-step process yields a comprehensive set of data, the DREs cannot effectively consider all of the factors in their decision-making process (Heishman, Singleton & Crouch, 1996, 1998; Herling, 2003; Shinar & Schechtman, 2005). This feedback is not only consistent with the quantitative and qualitative results offered in this study, but also the decision-making and DEC Program literature. The DRE's tendency to focus on those factors that they perceive as providing the best information to make an accurate prediction was supported by the qualitative data collected as part of the intervi3ew process. These assertions move beyond the commonly identified variables related to transfer design of the transfer of training such as: similarity between training and job task, opportunity to practice skills during the training, and use of scenarios to simulate actual work setting (Ellis, 1965; Olson, 1998).

Transfer Design

When training is developed, it is critical for those responsible to the design and deployment of that training to consider how the transfer process affects individual learning, relative to the training, to ensure the achievement of the intended performance. Transfer design is one of input elements in the transfer of training process (Holton, 1996). The literature revealed that in order for positive transfer to occur, the training delivery needed to consider the context of the performance environment as well as provide opportunities to practice and apply the knowledge, skills, and attitudes learned in the training (Holding, 1965; Yamnill & McLean, 2001). Additionally, the researcher noted that the transfer of training literature focused on the benefits of using general principles as well as issues related to the near and far transfer of training (Goldstien, 1986; Laker, 1990; Yamnill & McLean, 2001).

In regards to the DEC Program, the researcher believes that the transfer design attends to the need for individuals learn within the context of the environment that the skills as well as provides for the opportunity to practice their new skills. The learning activities in DEC Program also focus on learning the principles related to observing physical and behavioral factors in order to predict a drug category(s) that causes impairment. The DEC Program utilizes a combination of initial training and periodic recertification to address issues related to the near and far transfer of learning (Baldwin & Ford, 1988; Yamnill & McLean, 2001).

One of the areas where the DEC Program could improve their transfer design is by using performance data that is relative to the state or local area. Analyzing and communicating trends, especially related to those factors that may be commonly misinterpreted or the impact of poly drug use on a DRE's decision-making, would encourage DREs to examine a variety of DIE situations. This approach would also facilitate the analysis of "the *why* that underlies what an individual is being taught" (Yamnill & McLean, 2001, p. 202).

Motivation to Transfer

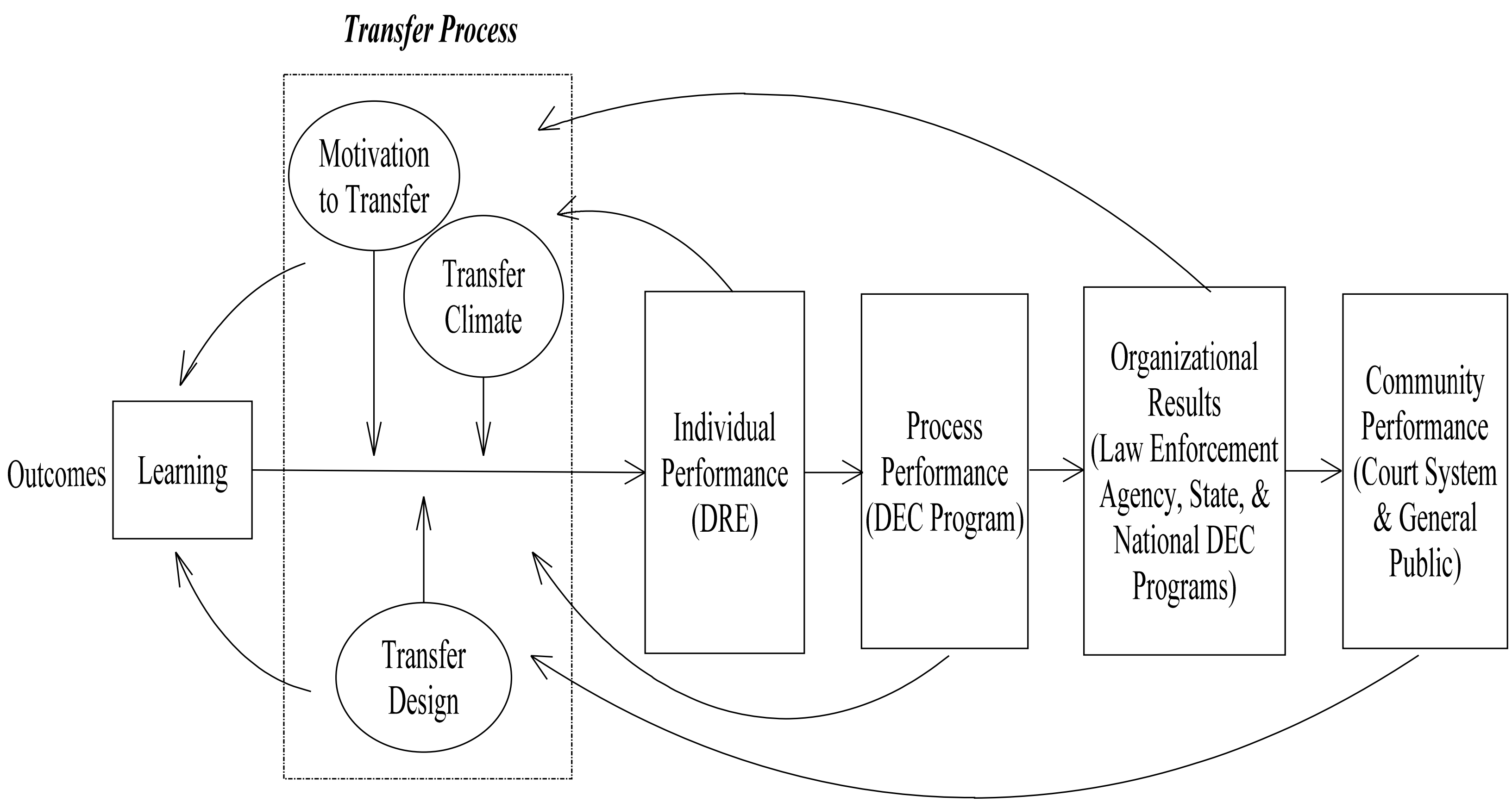
The researcher did not explore the motivation to transfer the initial DEC Program training as part of this study, but the interviews touched on the motivation to effectively use the training. It was evident from the interviews of the six DREs that they believed they processed the skills to accurately assess impaired individuals and predict a drug category(s). The DRE's confidence in their abilities is consistent with Noe and Schmitt's (1986) assertion that the motivation to transfer will manifest itself in behavioral change when the individuals have a strong desire to apply their knowledge and skills in the workplace. The researcher sensed a great deal of pride and confidence from the DREs in their abilities. Additionally, all six DREs appeared to be highly motivated to demonstrate their skills although there was some acknowledgement that opportunities to utilize the DEC Program were sometimes limited due to job assignment or policies.

Transfer Climate

One of the elements often cited in the transfer of training literature is the importance of feedback in the transfer climate (Baldwin & Ford, 1988; Olson, 1998; Yamnill & McLean, 2001). The researcher observed the importance of this factor as being critical during the training as well as in the job environment. As is the case in many work environments, the DEC Program has multiple modes for feedback. The first level of feedback comes from the results of the toxicology screening. At this point, the DRE receives feedback on their prediction accuracy according to drug category. The other levels, process organization, and community domains, provide feedback with respect to the individual DRE and DEC Program performance. Based on the interviews, both performance levels seem to receive only intermittent feedback from the performance domains. From the delays in receiving toxicology results to the lack of courtroom testimony experience, the impaired driving community creates a transfer climate that yields limited feedback and/or consequences for poor performance. Shoring up the feedback loop can enhance the transfer of training system can help to reinforce the training and create a climate that values performance by not only investing in the training, but also in how that training is implemented.

The feedback in the DEC Program is based on the communication of accuracy according to drug categories that may give an incomplete illustration of the overall effectiveness of the program. The DEC Program should seek ways of improving the data collection and analysis at the state level and, subsequently the national level as well as begin to look at the program as a system. By taking this strategic course, the program can indentify strengths, weaknesses, opportunities for improvement and threats to effectiveness that could serve as a basis for not only strategic improvement, but also increased operational effectiveness. In the past, the DEC Program has tended to focus on strengths of the program in terms of validation of a process and deal with specific threats based on challenges uncovered through the court systems. By utilizing a strategic approach, the DEC Program can build on their strengths, but address other issues proactively with an eye on continuously improvement of the process and the training. Fortunately, the recertification requirements provide a periodic opportunity for the DRE to receive new information and the DEC Program can instill the importance of decision-making and performance on the program as a whole. This recognition may serve to revitalize the transfer climate with each recertification training as well as improve the initial training process. This process of feedback and improvement is illustrated in Figure 24.

Figure 24. Proposed Transfer of Training Model as Applied to the DEC Program



Summary of Implications

The previous research related to the DEC Program rested exclusively in a postpositivist paradigm of inquiry. It is understandable that this approach was used due to the admissibility standards held by the justice criminal justice system. Unfortunately, this paradigm only paints part of the DEC Program picture. Numbers and quantitative data cannot exclusively describe human beings. It would be easier, especially in the court system, for the validate of a program such as the DEC Program to be cut and dry, but the human influence or variables drives a more holistic approach to researching individual decision-making. In the case of the DEC Program, these human variables are almost impossible to contain in an enforcement situation. The suspect can be under the influence of many different substances as well as being affected by the environment, food intake, sleep, or lack of sleep, and drug tolerance. If we add in the variables associated with the DRE such as experience, training, attitude, and observation skills along with the factors or combinations of factors that influence the DRE's prediction, we have a very complex system.

It is important to consider the paradigm that drives your base of inquiry. Researchers make choices on their approach to how research is conducted. A dissertation committee or a funding provider may drive those choices, but as HRD professionals, it important that we recognize and carefully consider the framework we use to conduct a study. As a scientist, I am comfortable with statistics, but as a human, I know there is more behind the numbers. In the case of the DEC Program, the background information provided by the six selected DREs gave a face not only to this study's quantitative results, but also supported some of the minor conclusions from the previous validation literature that have been ignored. This is especially true in terms of the number of factors that a DRE can effectively consider as part of their decision-making.

Recommendations for Future Research

This research has triggered a number of opportunities for further research. The future research includes topics related to human resource development specifically in the areas of decision-makings and the transfer of training as well as the continued evaluation of the DEC Program.

Research Regarding the DEC Program

One of the goals of completing this dissertation using problem statements from the traffic safety community was to develop a method for assessing the DEC Program that could be used within an individual state or at the national level. Based on the results of this study, the researcher will further refine the methodology and seek funding to conduct similar studies with a larger data set that can better represent the DRE population in a state or nationally. This type of study would utilize pre-existing data from a broader base of DREs and DEC Programs (suggest 3-4 states possibly with different training strategies). This approach would also help to inform the training process in the DEC Program at a national level since all of the training materials are produced by the National Highway Traffic Safety Administration (NHTSA) in cooperation with the International Association of Chiefs of Police (IACP).

Examining Drug Influence Evaluations (DIEs) Involving Only One Drug Category

In addition to conducting a study similar to this dissertation, there are a number of other research opportunities availed by this research. Another approach to examining the accuracy and factors that may influence a DRE's prediction is to focus on field results that only involve individual drug categories. Although the proposed approach only represents a portion of those DIEs conducted as part of the DEC Program, it would help to identify those factors or combinations of factors, based on enforcement observations that influence the DRE's ability to predict a drug category. In addition to this data set, researchers should use the national DRE Tracking database to identify frequently observed drug combinations. These combinations should also be analyzed using enforcement data. Both of these approaches will strengthen the traffic safety community's knowledge about the effectiveness of the DEC Program's 12-step process and inform the training with sound, current research.

Using Toxicology Reports to Examine the Presence of a Drug Category with More Precision

This study used the DRE's rolling logs to determine the presence of a drug category in the toxicology results. As a follow-up to this study, it would be informative to use the actual toxicology results as a comparison for accuracy. The participation of a qualified forensic toxicologist with a strong working knowledge of the DEC Program would be imperative to this type of study. By utilizing the actual toxicology report, the researcher could move beyond the concept of the drug category(s) being present or not present to how the level present may affect the observation of factors and the prediction of a DRE. This study could address issues related to the presence of metabolites as well as other perceptions that the DREs may have related to the information available on the toxicology reports.

Research Regarding Human Resource Development (HRD)

During the process of completing this study, the researcher realized the need for applying the models and theories associated with HRD, specifically the transfer of training, to training programs similar to the DEC Program. Based on the feedback from those DREs interviewed for this study, the researcher believes that it would be beneficial to investigate the impact of transfer climate on the DRE's perceptions of the program, training, and expected performance. State and federal governments dedicate significant amounts of funding to the training of law enforcement and other traffic safety professionals to combat the issue of impaired driving. Local and state agencies allocate additional funding for enforcement resources directly related to impaired driving. These agencies pay little attention to how affectively the transfer of training to the work environment in terms of improved enforcement, assessment, prosecution, and/or conviction. This type of research would benefit the DEC Program at the national and state level. The considerable investment of tax dollars warrants the employment of research-based techniques and systems that can optimize the impact of the funding. HRD can be a major contributor to the effectiveness of the program and the use of HRD type research can serve to inform the DEC Program as well as its stakeholders.

Within the larger frame of HRD, the researcher believes that additional research should be undertaken to examine how individuals use factors or combinations of factors to make decisions based on training received as part of their work activities. Organizations and communities spend a great deal of time and money to train individuals to make decisions in a wide variety of situations. When training is develop to assist these individuals in navigating through these situations, those developing the training should make a conscious effort to attend to issues related to the transfer design, transfer climate, and the motivations that individuals may have to transfer the training into performance in their work environment. Yamnill and McLean (2001) employ identical elements theory and principles theory to the transfer of training specifically in the area of transfer design, but these theories provide a framework for those developing and deploying training. By gaining a fuller appreciation for the impact of these theories on the transfer of training through research examining the influence of the transfer of learning on performance in specific training programs, this research can inform the HRD community to improve training during both development and deployment.

Summary

The factors or combinations of factors that influence an individual's decision-making are critical to all processes. By exploring which factors provide the most positive influence and discover how to train individuals to utilize those factors in the most optimal fashion, we can affect performance. If the field of HRD endeavors to transfer training effectively by optimizing the transfer design, promoting the individual's motivation to use their learning on the job, and creating a transfer climate that facilitates that transfer of learning, the traffic safety community can uncover methods by which it can sustain an effective system of detecting and assessing the drug impaired driving. The benefits of this effort are tangible on a number of levels. A return on the investment is through the effective deployment of trained resources that are capable and motivated to identify and assess individuals suspected of driving while impaired. The DREs are equipped with an effective tool that assisted them in enforcing the law and testifying to their observations in court. The DRE is able to judge an impaired individual in a fair, effective manner after removing the individual from a potentially dangerous driving situation. This process results in safer roads for all.

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APPENDIX A

TEXAS DRUG INFLUENCE EVALUATION FACE SHEET

TEXAS DRE FACE SHEET

Evaluator	DRE No.	Rolling log No.	Case Number	Evaluator's Agency
Recorder/Witness	Crash: ☐ None ☐ Fatal ☐ Injury ☐ Property		Misc. No.	Arresting Officer's Agency

Arrestee's Name: (Last, First, MI)	DOB:	Gender:	Race	Arresting Officer:

Date Examined / Time / Location	Breath Results: ☐ Refused Instrument #	Chemical Test: ☐ Refused ☐ Urine ☐ Blood

Miranda Warning Given: ☐ Yes ☐ No By:	What have you eaten today? When?	What have you been drinking? How much?	Time of last Drink?

Time Now?	When did you last Sleep? How long?	Are you sick or injured? ☐ Yes ☐ No	Are you diabetic or epileptic? ☐ Yes ☐ No

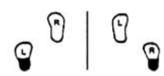
Do you take insulin? ☐ Yes ☐ No	Do you have any physical defects? ☐Yes ☐ No	Are you under the care of a Doctor / Dentist? ☐ Yes ☐No

Are you taking any medication or drugs? ☐ Yes ☐ No	ATTITUDE	COORDINATION
	BREATH	FACE

SPEECH	EYES ☐ Reddened Conjunctiva ☐ Normal ☐ Bloodshot ☐ Watery	Blindness: ☐ None ☐ Left Eye ☐ Right Eye	Tracking: ☐ Equal ☐ Unequal
CORRECTIVE LENS: ☐ None ☐ Glasses ☐ Contacts, if so ☐ Hard ☐ Soft	PUPIL SIZE: ☐ Equal ☐ Unequal (explain)	Able to follow stimulus: ☐ Yes ☐ No	Eyelids: ☐ Normal ☐ Droopy

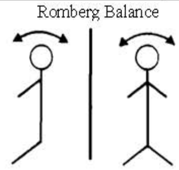
PULSE & TIME	HGN	Right Eye	Left Eye	Vertical Nystagmus ☐Yes ☐ No
1 /	Lack of Smooth Pursuit			Convergence
2 /	Maximum Deviation			Right Eye Left Eye
3 /	Angle of Onset			

ONE LEG STAND:

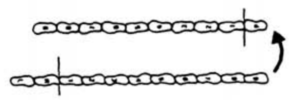


L R
☐ ☐ Sways while balancing
☐ ☐ Uses arms for balance
☐ ☐ Hopping
☐ ☐ Puts foot down

Romberg Balance



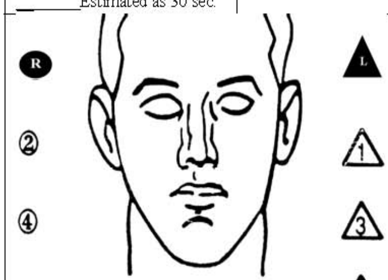
Walk And Tun Test



Cannot keep balance ______________
Starts too soon ______________

	1st Nine	2nd Nine
Stops Walking		
Miss Heel – Toe		
Steps off line		
Raises arms		
Actual # Steps		

INTERNAL CLOCK ______Estimated as 30 sec.	Describe Turn	Cannot do test (explain)	Type of Footwear



PUPIL SIZE	Room light	Darkness	Direct
LEFT EYE			
RIGHT EYE			

HIPPUS ☐ Yes ☐ No
REBOUND DILATION ☐ Yes ☐ No

NASAL AREA

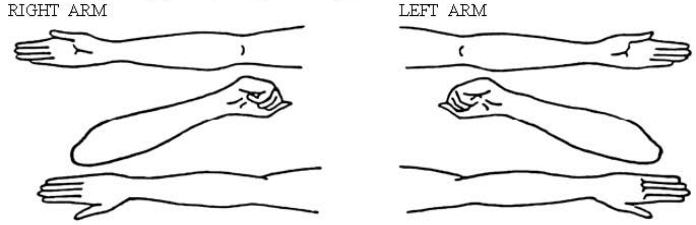
ORAL CAVITY

Reaction to Light

BLOOD PRESSURE ______/______
TEMPERATURE ______°F

Muscle Tone: ☐ Near Normal ☐ Flaccid ☐ Rigid
Comments:

RIGHT ARM LEFT ARM



ATTACH PHOTOS OF FRESH PUNCTURE MARKS

What medicine or drug have you been using?	How much?	Time of use?	Where were the drugs used? (location)

Member Signature (Include rank)	ID #	Reviewed by:

APPENDIX B

DEC PROGRAM DRUG CATEGORY MATRIX

INDICATORS CONSISTENT WITH DRUG CATEGORIES

	CNS DEPRESSANTS	CNS STIMULANTS	HALLUCINOGENS	DISSOCIATIVE ANESTHETICS	NARCOTIC ANALGESICS	INHALANTS	CANNABIS
HGN	PRESENT	NONE	NONE	PRESENT	NONE	PRESENT	NONE
VGN	PRESENT (HIGH DOSE)	NONE	NONE	PRESENT	NONE	PRESENT (HIGH DOSE)	NONE
LACK OF CONVERGENCE	PRESENT	NONE	NONE	PRESENT	NONE	PRESENT	PRESENT
PUPIL SIZE	NORMAL (1)	DILATED	DILATED	NORMAL	CONSTRICTED	NORMAL (4)	DILATED (6)
REACTION TO LIGHT	SLOW	SLOW	NORMAL (3)	NORMAL	LITTLE TO NONE VISIBLE	SLOW	NORMAL
PULSE RATE	DOWN (2)	UP	UP	UP	DOWN	UP	UP
BLOOD PRESSURE	DOWN	UP	UP	UP	DOWN	UP/DOWN (5)	UP
BODY TEMPERATURE	NORMAL	UP	UP	UP	DOWN	UP/DOWN/NORMAL	NORMAL

*high dose for that individual

FOOTNOTE:
These indicators are those most consistent with the category, keep in mind that there may be variations due to individual reaction, dose taken and drug interactions.

(1) SOMA, Quaaludes and some anti-depressants usually dilate pupils.
(2) Quaaludes and ETOC and possibly some anti-depressants may elevate.
(3) Certain psychedelic amphetamines may cause slowing.
(4) Normal, but may be dilated.
(5) Down with anesthetic gases, up with volatile solvents and aerosols.
(6) Pupil size possibly normal.

	CNS DEPRESSANTS	CNS STIMULANTS	HALLUCINOGENS	DISSOCIATIVE ANESTHETICS	NARCOTIC ANALGESICS	INHALANTS	CANNABIS
GENERAL INDICATORS	Disoriented Droopy Eyelids (Ptosis) Drowsiness Drunk-like behavior Flaccid muscle tone Gait Ataxia Slow, sluggish reactions Uncoordinated Thick, slurred speech NOTE: With Methaqualone, pulse will be elevated and body tremors will be evident. Alcohol and Quaaludes elevate pulse. Soma and Quaaludes dilate pupils.	Anxiety Body tremors Dry mouth Euphoria Exaggerated reflexes Excited Eyelid/tremors Grinding teeth (Bruxism) Increased alertness Insomnia Irritability Redness to nasal area Restlessness Runny nose Talkative Rigid muscle tone	Body tremors Dazed appearance Disoriented Difficulty w/speech Flashbacks Hallucinations Memory loss Nausea Paranoia Perspiring Poor perception of time & distance Rigid muscle tone Synesthesia Uncoordinated NOTE: With LSD, piloerection may be observed (goose bumps, hair standing on end)	Blank stare Confused Chemical odor (PCP) Cyclic behavior (PCP) Difficulty w/speech Disoriented Early HGN Onset Hallucinations Incomplete verbal responses Increased pain threshold Loss of memory "Moon walking" (PCP) Non-communicative Perspiring (PCP) Possibly violent (PCP) Rigid muscle tone Slow, slurred speech Sensory distortions	Constricted pupils Depressed reflexes Drowsiness Droopy eyelids (Ptosis) Dry mouth Euphoria Facial itching Flaccid muscle tone Nausea "On the Nod" Puncture marks Slow, low, raspy speech Slowed breathing NOTE: Tolerant users exhibit relatively little psychomotor impairment.	Bloodshot, watery eyes Confusion Disoriented Flaccid or normal muscle tone Flushed face Intense headaches Lack of muscle control Non-communicative Odor of substance Possible nausea Residue of substance Slow, thick, slurred speech NOTE: Anesthetic gases cause below normal blood pressure; volatile solvents and aerosols cause above normal blood pressure.	Body tremors Disoriented Debris in mouth Eyelid tremors Impaired perception of time & distance Increased appetite Marked reddening of conjunctiva Odor of Marijuana Relaxed inhibitions Possible paranoia

APPENDIX C

FIELDWORK MEMO EXAMPLE

Melissa Walden
Fieldwork Memo #1: Participant Selection and Interview Transcribing
November 2007

This fieldwork memo describes the process I used to select the drug recognition experts (DRE) to be interviewed as part of my dissertation. The quantitative data represented only those drug influence evaluations (DIE) completed in Texas during a selected period. (INSERT TIME PERIOD). Those DIEs were selected based on criteria related to the evaluation not the DRE. As part of the qualitative part of this study it was important to me to uncover how individual DREs felt about the factors or combinations of factors that they perceived influenced their decisions during a DIE.

Background Information

The DRE community is very close. There is a perception that any one who might question the Drug Evaluation and Classification (DEC) Program's process or not abide by the party line might some how damage the credibility of the program. Based on the research reviewed as part of this study, it was clear that a DRE could not possibility consider all of the factors or combinations of factors detailed in the DEC Program's 12-step process, so it was important to me to try to identify those factors or combinations of factors that the individual DRE does rely on more heavily during their decision-making process. As a research, I felt that the opinions of the DREs might confirm or provide additional insight based on the information uncovered in the quantitative analysis.

Since the DRE's actual words (quotes) would be used in the reporting of the results of this study, it was important to keep those that choose to be interviewed anonymous.

Participate Selection Process

Initially, I went to the State Coordinator for the Texas DEC Program to help identify possible participants for the interviews. During that communication period, I decided that I would use an alternative approach to ensure better anonymity for the participants. Having worked with the DEC Program both directly and indirectly over the last seven years, I asked one of the more experienced DRE's I knew to be the initial interview. Following that interview, I asked the participant to suggest three other DREs that might have similar experiences and three who might have had different experiences. I defined experiences to the participant as the following:

- What type of agency the DRE was assigned (state, municipal, county, small, large, etc.)
- Experience
- Whether or not the DRE was trained as an instructor or practitioner
- Type of demographic area to which they were assigned (urban, rural, suburban)
- Area of the state (geographic area)
- Courtroom experience

Based on their feedback, I selected on of the individuals that participant one had suggested might have a different set of experiences to report. I repeated this process until I completed six interviews.

Interestingly, several DREs suggested the same names, although they sometimes were suggested as having the same experiences while others were considered to have different experiences. During the interview selection process, five of the DREs invited chose not to be interviewed. Although several did not indicate why they would not participate, two indirectly indicated that my husband's professional affiliation with the defense community as a reason for not participating in the interviews. It should be noted that my husband is no longer affiliated with the DWI defense community.

I emailed each potential participant to invite them to participant in the interview. As part of the email invitation I included a brief overview of the study along with the information sheet approved for use by the IRB. I indicated that the interview would be conducted at a location of their choice and that I would travel to their local area to conduct the interview. I also let them know that the interview would be recorded using a digital recording device and that the recording would be transcribed and coded. I also assured them that the original recording would be destroyed after the study was completed and that there would be no reference included in the transcript that connected their comments to them as individuals or their agencies.

A summary of the participants and the selection process are documented in Table 1.

Each potential interview participant was sent an information sheet that described the project and the interview process. This information helped the potential participant to understand how the study could inform the DEC Program and improve the training and decision-making process associated with the program. The information sheet used to invite participants to be interviewed in included in Figure 1.

Table 1. Potential Study Participants, Agency and Training Type, and Invitation Status

#	Name	Type of Agency	Instructor or Practitioner	Invited	Date	Response	Reference
1	XXXXXX	State	Instructor	Yes	6/2/2007	Yes	Previous Professional Association
2	XXXXXX	State	Practitioner	Yes	6/6/2007	No	Referral
3	XXXXXX	Municipal	Instructor	Yes	6/10/2007	Yes	Referral
4	XXXXXX	State	Instructor	No		N/A	Referral
5	XXXXXX	County	Practitioner	No		N/A	Referral
6	XXXXXX	State	Practitioner	No		N/A	Referral
7	XXXXXX	Municipal	Instructor	No		N/A	Referral
8	XXXXXX	State	Instructor	Yes	6/10/2007	No	Referral
9	XXXXXX	Municipal	Instructor	Yes	7/15/2007	No	Referral
10	XXXXXX	Municipal	Practitioner	No		N/A	Referral
11	XXXXXX	Municipal	Instructor	Yes	6/22/2007	Yes	Referral
12	XXXXXX	Municipal	Instructor	No		N/A	Referral
13	XXXXXX	Municipal	Practitioner	Yes	7/23/2007	No	Referral
14	XXXXXX	Municipal	Practitioner	No		N/A	Referral
15	XXXXXX	State	Instructor	No		N/A	Referral
16	XXXXXX	County	Practitioner	Yes	7/8/2007	Yes	Referral
17	XXXXXX	Municipal	Practitioner	Yes	8/2/2007	No	Referral
18	XXXXXX	State	Instructor	No		N/A	Referral
19	XXXXXX	Municipal	Practitioner	Yes	7/25/2007	Yes	Referral
20	XXXXXX	Municipal	Instructor	No		N/A	Referral
21	XXXXXX	County	Practitioner	No		N/A	Referral
22	XXXXXX	State	Practitioner	Yes	8/10/2007	Yes	Referral

Figure 1. Recruiting Information Sent to Potential Participants via Email

INFORMATION SHEET FOR POTENTIAL STUDY PARTICIPANTS

Title of the Study: *Examination of Decision Making Factors Influencing Field Performance Utilizing the Drug Evaluation and Classification Program to Identify Suspected Impaired Drivers as Reported by Selected Certified Police Officers in Texas*

My name is Melissa Noggle Walden and I am a research scientist at the Texas Transportation Institute's Center for Transportation Safety and a doctoral student in the College of Education and Human Development at Texas A&M University in College Station. I am currently conducting research related to my dissertation that will examine how decision making factors influence the accurate prediction of a drug category during a drug recognition expert's (DRE) drug influence evaluation (DIE) as part of the Drug Evaluation and Classification (DEC) Program in Texas. I am looking for up to ten officers to participate in the study by agreeing to be interviewed in relation to their experiences with conducting drug influence evaluations. You were selected to be a possible participant because you are currently a certified DRE in the State of Texas. The purpose of this part of the study, that you will be participating in, is to determine which factors or combination of factors influence a DRE's accurate decision of the drug category(s) responsible for the impairment of the suspect being evaluated. In addition, existing information from the DRE Tracking database will be used to determine to what extent DRE predictions agree with instructor predictions as well as the associated toxicology results.

If you agree to be in this study, you will be asked to identify those factors or combination of factors (such as, but not limited to: horizontal gaze nystagmus, pupil size, performance on sobriety tests, and pulse) that you perceive as influencing an accurate prediction of a drug category(s) in a DIE. This information will be gathered through a semi-structured interview that will be recorded through audio taping and note taking on the part of the researcher. This study will take not more than one hour for the interview, and the researcher may need to contact the participant via phone if clarification of the responses is necessary. The responses will be anonymous and the original interview materials will be destroyed after the completion of the study.

The interviews will be conducted either in College Station or your local area. The interviews can be conducted either on- or off-duty depending on the preference of the participant and the policies of their agency. It is expected that the interviews will take place between May 27, 2007 and August 30, 2007. You will receive no monetary compensation for your participation in this study.

If you have any questions related to this study or possible participation, please contact me through any of the following:

Office Phone:	(979) 845-8514	Cell Phone:	(979) 224-6305
Home Phone:	(979) 690-9808	Email:	mwalden@tamu.edu

Thank you in advance for your possible participation in this project.

Interviews

Each interview began with introductions and an explanation of how the interview would proceed. I also explained why I chose this subject to research for my graduate work and what I expected to happen with the results. I assured each participant that their identity would remain confidential and that any interview data would not be attributed to any individual. I explained the member-check process and offered access to the final dissertation documentation.

Each interview was audio recorded via a digital recorder so that it could be easily transcribed after being transferred to MP3 files on my computer. All of the interviews were conducted at a location that was convenient and comfortable for the participant. Four of the six the interviews were conducted in a neutral location in the community where the DRE worked. The other two were conducted in their offices.

Immediately after each interview, I scheduled time to reflect on the interview and add detail to the notes I took during the interview. I found it very difficult to take specific notes during the actual interview, because it seemed to take away from the communication with the participant. I felt like I needed to be paying attention to what and how the participants were convening the information during the interview. I found that if spent too much time trying to write down information, it disrupted the flow of the discussion. Since the questioning was not intended to be very structured, it was important for me to tune into what the participant was saying so that I could follow-up with clarification questions. I found this process to be very frustrating. To address some of the frustration on my part, I tried to vocalize some of my thoughts so that they would be captured through the transcription as well as spend time immediately following the interview to record my thoughts. Although I believed I was a proficient listener, this type of interview process (as a means of capturing data in a systematic manner) was a challenge. I came to believe that the researcher needs a lot of practice to ensure that they perform as the best instrument possible. I felt an overwhelming sense of responsibility to carry forward the participant's reflections in the most accurate way possible.

Based on this participant selection process, I believe that I was able to capture some rich information related to the DRE's perceptions of which factors or combinations of factors influence their decision-making process during a DIE.

Transcribing the Interviews

I transcribed each interview directly into MS Word as closely possible to the original conversation. I excluded filler words such as *um* or *uh* as well as any words that were repeated.

After I completed the initial transcription, I reviewed the transcript while listening to the recording of the interview to ensure my transcription accuracy. I then edited the transcription to remove any references to the participant and/or their agency, any other individual or agency, as well as any other information that could link the interview with the individual participant. I saved this version as the base file. I then proceeded to edit the base file for gross grammatical errors and added any information that may help to clarify the interview comments after the data was divided into segments. Any added comments were contained in and designated by brackets.

After transcribing, reviewing and editing the interview documentation, I forwarded the updated file to each of the respective participants for review and comment. This member check revealed the following for each of the interview participants. The responses from the member-check are provided in Table 2.

Table 2. Member-Check Status of Interview Transcripts

Interview #	Feedback from Participants
1	Returned - No Comments
2	Returned - No Comments
3	Not Returned
4	Returned - Several clarifications
5	Not Returned
6	Returned - No Comments

Data Analysis Process

The data analysis was conducted using the base transcripts with the member-check comments included for the one interview where the participant added clarifying commentary. Since these files were already documented in MS Word format, it was easy to change the layout from the common 8.5" x 11" size to the 3" x 5" index card size. After this transition was complete, the data in the transcripts was broken up by units of data and assigned to a card. Each unit of data was divided onto separate index cards and numbered. This process was repeated for each of the six interviews. The numbering began with the first interview and continued through each of the subsequent interviews.

Reflections

Based on my reflections across the interviews, it seems that several recurrent themes seem to emerge. The first is that those participants who were instructors seemed to identify pulse and pupil size as the driving factors in their decision-making. They seemed to have a good understanding of those observations that can trigger incorrect predictions if they are not taken in context with other observations. On the other hand, those DREs with less experience, tended to rely on an extended battery of the SFSTs (HGN, VGN, MAT, OLS, Romberg, and finger-to-nose) as their basis for prediction during a DIE.

All of the participants mentioned the concept of make decisions based on the *totality of the evidence*, but were comfortable admitting to the use of some subset of that evidence on which they based their decisions. One thought that crossed my mind as I was interviewing each of the participants was that, in their individual way, they used their job experiences to compliment their DRE training and it did not seem possible to separate the impact of their experience from their training. So, although identifying which factors or combinations of factors influence the DRE decision-making process is important from a training and process standpoint, it is only one part of what influences the individual's performance on a DIE. Additionally, it is easy to tell that the

DREs received standardized training since they tended to use the same language, but it also appeared that each DRE seemed proud to share how they have used their experience and training (in addition to the DEC Program) to focus on those variables that they felt were the most reliable.

VITA

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	Engineer and Program Manager, Technology and Economic Development Division, Texas Engineering Extension Service, College Station, TX, 1995-2000
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